INTERAVIA

REVIEW OF WORLD AVIATION

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U. S. A.:	80 cents
British Isles:	3 s
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Denmark:	d. Kr. 5.-
Germany:	DM 2.75
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IN THIS ISSUE

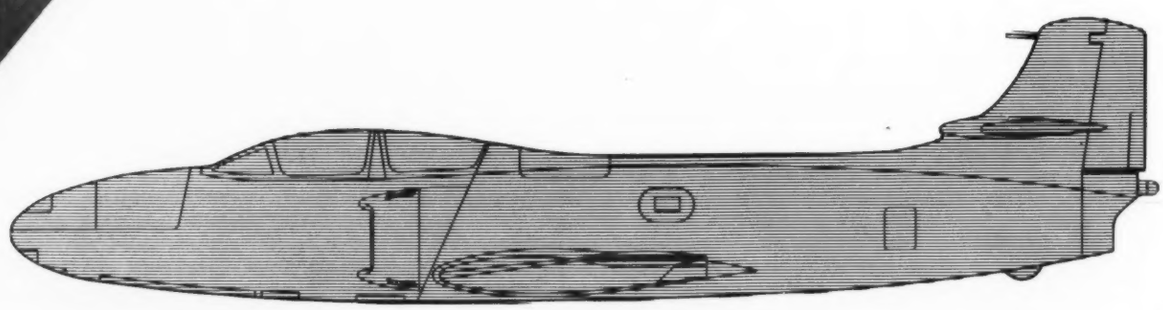
PROSPECTS 1954

Interceptor Power Plants

VOLUME IX 2 1954

FIAT G.82

(R.R. Nene turbojet)



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INTERAVIA

Review of World Aviation

Volume IX | No. 2 | 1954

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Contents

OUTLOOK FOR 1954 (I)		**79**
" I'm not Afraid to Fly "		**88**
Convair Tradewind		**91**
A Conservative Revolutionary—Donald W. Douglas		**92**
" Super Connie " in Production		**97**
Parachute Development in the United States		**102**
Albert Plesman		**104**
Progress in Pictures		**106**
What's in the Air ?		**109**
Reheat Turbojet or Ramjet Propulsion ?	E. SÄNGER, PARIS	**111**
The Mind of Mr. Reader		**114**
Book Reviews		**115**

Front cover

Prospects ... France's SE 5000 " Baroudeur " close-support aircraft may be the forerunner of a new fleet of tactical aircraft capable of operating without costly and vulnerable air bases.

Appears Monthly in Four Editions : English, French, Spanish and German.

Advertising Department, Publishing and Editorial Offices, Subscription Department : Interavia S. A., 6, Corraterie, Geneva. Telephone : 5 42 34 (five lines). Cables and Telegrams : Interavia-Geneva. Teleprinter : 2 21 22. Postal Cheque Account : Geneva I 5380.

Annual Subscriptions : Switzerland, Sw. frs. 28.00 ; U.S.A. and Canada, $7.00 ; Great Britain, £1 15s 0d ; France, Fr. frs. 2,400 ; Belgium, Belg. frs. 360.00 ; Holland, Fl. 28.00 ; Germany, DM 27.50 ; Sweden, Kr. 35.00 ; Norway, Kr. 50.00 ; Spain, Ptas 275.00 ; Austria, ö. S. 180 ; Brazil, 230 Cr$; Uruguay, 23 pesos. All other countries : Sw. frs. 28.00.

Agents and Distributing Offices :

INTERAVIA AUSTRIA :	Morawa & Co., Wollzeile 11, Vienna I.
INTERAVIA BELGIUM :	Office de Publicité, 16, rue Marcq, Brussels.
INTERAVIA BRAZIL :	R. F. Besnard, 91 av. Almirante Barroso, S. 417-419, Rio de Janeiro. 131, rua Marconi 5e And., Sao Paulo.
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INTERAVIA GERMANY :	Interavia GmbH., Lohausen Airport, Düsseldorf. Subscriptions and single copies : Ausland-Zeitungshandel W.E. Saarbach, Gereonstrasse 25-29, Cologne 1. Postal Cheque Account Cologne 25823.
INTERAVIA GREAT BRITAIN :	Interavia (United Kingdom) Ltd., 2-5, Old Bond Street, London, W. 1.
INTERAVIA HOLLAND :	Rotterdamsche Couranten-Import en Kioskenonderneming v/h van Ditmar, Postbus 262, Rotterdam.
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INTERAVIA URUGUAY :	R. F. Besnard, Edificio Artigas Rincón 487, Montevideo.
INTERAVIA U.S.A. :	185, Madison Avenue, New York 16, N.Y. Subscriptions also from the International News Co., 131 Varick Street, New York, N.Y.

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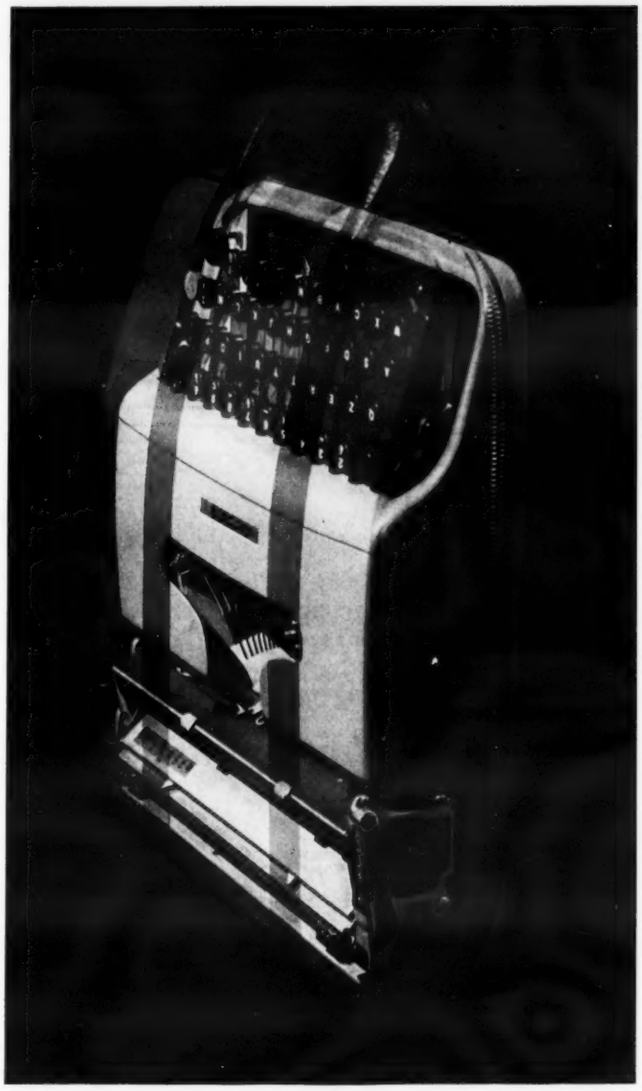
Printed in Switzerland

Imprimerie de " La Tribune de Genève ", Geneva
A.G. Fachschriften-Verlag und Buchdruckerei, Zurich



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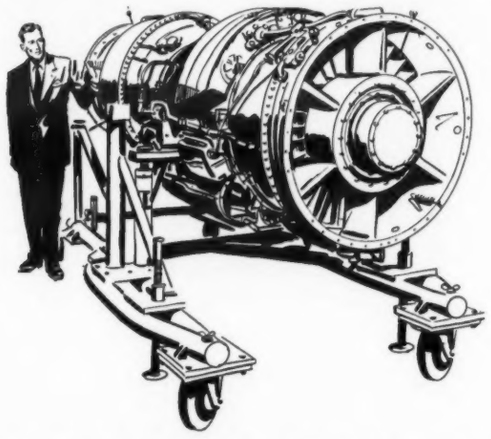
United Airgram

UNITED AIRCRAFT EXPORT CORPORATION

J-57 OFFICIALLY RATED IN 10,000-POUND THRUST CLASS

The J-57, Pratt & Whitney Aircraft's big, new turbojet engine, has been officially rated in the 10,000-pound thrust class, making it the first turbojet in aviation history to achieve a five-figure power rating, and the most powerful jet now in production. The new engine has been under close military security wraps since its inception. Not until last November were external photographs made public.

William P. Gwinn, general manager of Pratt & Whitney Aircraft, said "We believe the J-57 is at least two years in advance of any other engine we know of in the turbojet field. This includes British as well as American jet engines."



The U.S. Air Force, for whom the big jet was first manufactured, disclosed that the J-57 has the lowest specific fuel consumption of any turbojet engine presently in production for its aircraft, as well as a rapid rate of acceleration.

The P&WA design for the axial-flow engine, incorporates an arrangement of dual compressors in line, which gives the engine a high compression ratio and unusual fuel economy.

J-57 production began at East Hartford in February, 1953. The engine powers the Air Force's new heavy jet bomber, the Boeing B-52 Stratofortress, and the new supersonic fighters, the North American F-100 Super Sabre, holder of the world's speed record, and the Convair F-102. McDonnell's F-101 Voodoo is also scheduled to have the J-57, as are the Navy's Douglas A3D attack bomber, and Douglas F4D fighter.

NEW HAMILTON STANDARD FACILITIES SPEED PRODUCT DEVELOPMENT

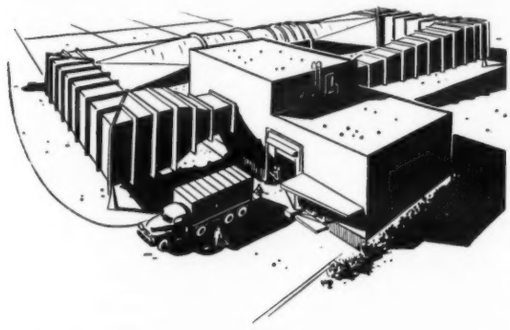
Extensive new development laboratories have been completed at the Hamilton Standard plant in Windsor Locks, Connecticut, to give this United Aircraft Corporation division one of the most complete facilities of its kind in the world.

The laboratories contain new propeller test cells, each capable of taking test propellers up to 28 feet in diameter and engines up to 20,000 horsepower. A giant "clamshell" type altitude chamber has also been installed, in which 20-foot propellers can be tested at simulated altitudes of 100,000 feet. Both the test cells and the altitude chamber indicate the extent of Hamilton Standard's development work with huge new propellers for future cargo and transport aircraft.

The big laboratories also contain development and test facilities for the division's extensive work in the aircraft equipment field. Included are (1) fuel control laboratory, containing a sound-proofed test cell which is able to take jet engines of up to 25,000 pounds of thrust in testing fuel controls and other accessories; (2) pneumatics laboratory, with huge machines to compress, heat, or evacuate air, all designed for further development of air cycle cooling units, pneumatic starters, valves, control systems and similar products; (3) combustion laboratory, with explosion-proof test chambers and remote control equipment designed for advanced work on self-contained engine starters and auxiliary power supplies for guided missiles; (4) hydraulics laboratory, with complete facilities for hydraulic and mechanical testing of propeller components, variable displacement pumps and similar equipment.

WIND TUNNEL UNDER CONSTRUCTION AT CHANCE VOUGHT AIRCRAFT

Construction of a low-speed wind tunnel, costing approximately $1 million, has been started at the Chance Vought Aircraft factory in Dallas, Texas, for use in the division's jet aircraft and guided missile programs. The division has been using various facilities in other parts of the United States for its test work in the low speed ranges. Now, however, the requirements for such work have grown to the point where an immediately available tunnel is essential to meet schedules.



Airspeeds in the wind tunnel test section will range up to 200 m.p.h., which is adequate for design studies concerned with the aerodynamic problems of such speed ranges as take-off, low-speed cruising, and landing. A 20-foot fan, powered by a 1500 h.p. motor, supplies air for the 7 by 10-foot test section. Models under test will be remotely controlled through a wide variety of loads and flight attitudes, and resulting data will be recorded automatically.

SIKORSKY PLANS NEW FACTORY FOR S-56

A new branch factory, containing approximately 500,000 square feet of floor space, will be built by Sikorsky Aircraft in Stratford, Connecticut, only a few miles from the present plant at Bridgeport. Twin-engine S-56 type helicopters for the U.S. Marine Corps will be made in the new plant on its 200-acre site. Sikorsky's plans, at present, call for about 3000 employees for the Stratford factory, in addition to the 4500 people now working at the main plant in Bridgeport.

The S-56 type, in its military version will be able to carry 26 soldiers with full battle equipment. Sikorsky expects to produce, in the not too distant future, a civilian version comparable in capacity to a twin-engine airliner.

Meanwhile, National Airlines has put a Sikorsky S-55 helicopter into operation, thus becoming the first major scheduled passenger airline in the U.S.A. (and second to Sabena, in the world) to utilize a large transport helicopter. National plans to carry passengers with helicopters to its main trunkline terminal at Miami, Florida.

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Bendix products safeguard every stage of flight

Whatever your place in aviation, or whatever you plan to do, Bendix merits a place in your plans. The reason lies in the unparalleled range of Bendix experience in this field. This constantly growing organization of 6,000 engineers, 15 research centers and 25 manufacturing plants builds more different products for aviation . . . concentrates a wider range of skills and talents on its problems . . . and has accelerated progress in more directions than any other single company. For example, Bendix is presently engaged not only in forwarding commercial flight, but is also deeply engaged with jets, rockets and guided missiles. In fact, Bendix activities are as fundamental to aviation as the weather.

Meteorology—Bendix builds the telemetering equipment which, carried aloft by rocket or balloon, transmits meteorological data from the upper air. Long-range forecasting utilizing this information, plus accurate minute-to-minute recordings by Bendix* Aerovanes*, Hygro-thermographs and Micro-barographs in weather bureaus and airports forms the basis of flight plans the world over.

DEPENDABLE TAKE-OFFS
with Bendix ignition and fuel systems

Take-off—On the runway Bendix products safeguard every phase of starting. Bendix VHF radio transmits tower instructions with complete clarity through the new Amspeaker*—the combination of amplifier, power supply and loudspeaker which replaces cumbersome headphones. A Bendix switch and Bendix generators start current through Bendix ignition harness and electrical connectors to the Bendix high or low tension ignition systems—world standard for reliability. A Bendix starter* whirls into life engines fed by Bendix* fuel metering systems with Bendix-filtered fuel. And Bendix instruments give the crew—linked by Bendix interphones—an accurate check on every factor requisite to sure take-offs.

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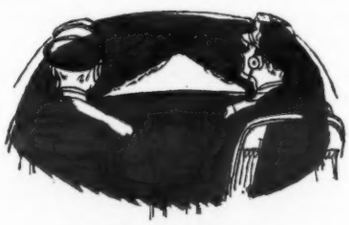

SAFER BAD WEATHER FLYING
with Bendix* ILS and GCA systems

Bad Weather Flying—Bad weather emphasizes the worth of Bendix advancements. Under instrument conditions the pilot simply flies the pointer of the Bendix OMNI-MAG which gives him, on *one* instrument, a continuous picture of his heading, course, reciprocals, wind drift and glide path. For high altitudes Bendix builds pressurization components and for icing produces de-icing equipment proved under the worst flight conditions. For bad weather landings, Bendix makes surveillance radar and both the ILS and Flight Path Control equipment which permit automatic flight down a special radio beam to the runway, and the GCA radar which enables an observer at a radar scope to follow exactly the plane's position and "talk" the pilot to a landing.

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Landing—Coming in, Bendix actuators ease down the Bendix landing gear for a positive, cushioned stop. Bendix* struts, wheels and brakes are standard for many varying types of planes.

Jets—Bendix creative engineering has naturally influenced jet design. Ignition systems, starter plugs, starters and generators, speed density fuel metering systems and fuel supply systems indicate Bendix products in this field—developments assuring fast starts despite fouled plugs, preventing flameouts and the hot starts and excessive heats which ruin jet engines.

Guided Missiles—Bendix is likewise prominently identified with many guided missile developments which, because of security reasons, cannot be specifically discussed here.

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Bendix AIRCRAFT MAGNETOS *

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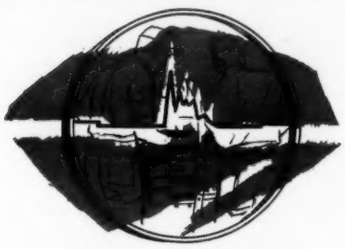

FASTER MAINTENANCE
with Bendix ignition analyzer

Maintenance—The vital matter of fast servicing benefits from Bendix in many ways. One example is the ignition analyzer, utilized as airborne equipment or as a portable ground unit. Installed on the plane, this electronic brain spots, during flight, defective spark plugs and ignition troubles anywhere in the system, and also indicates the remaining life in every plug. The many other kinds of Bendix testing equipment in world-wide use are equally notable for advanced design and superior efficiency.

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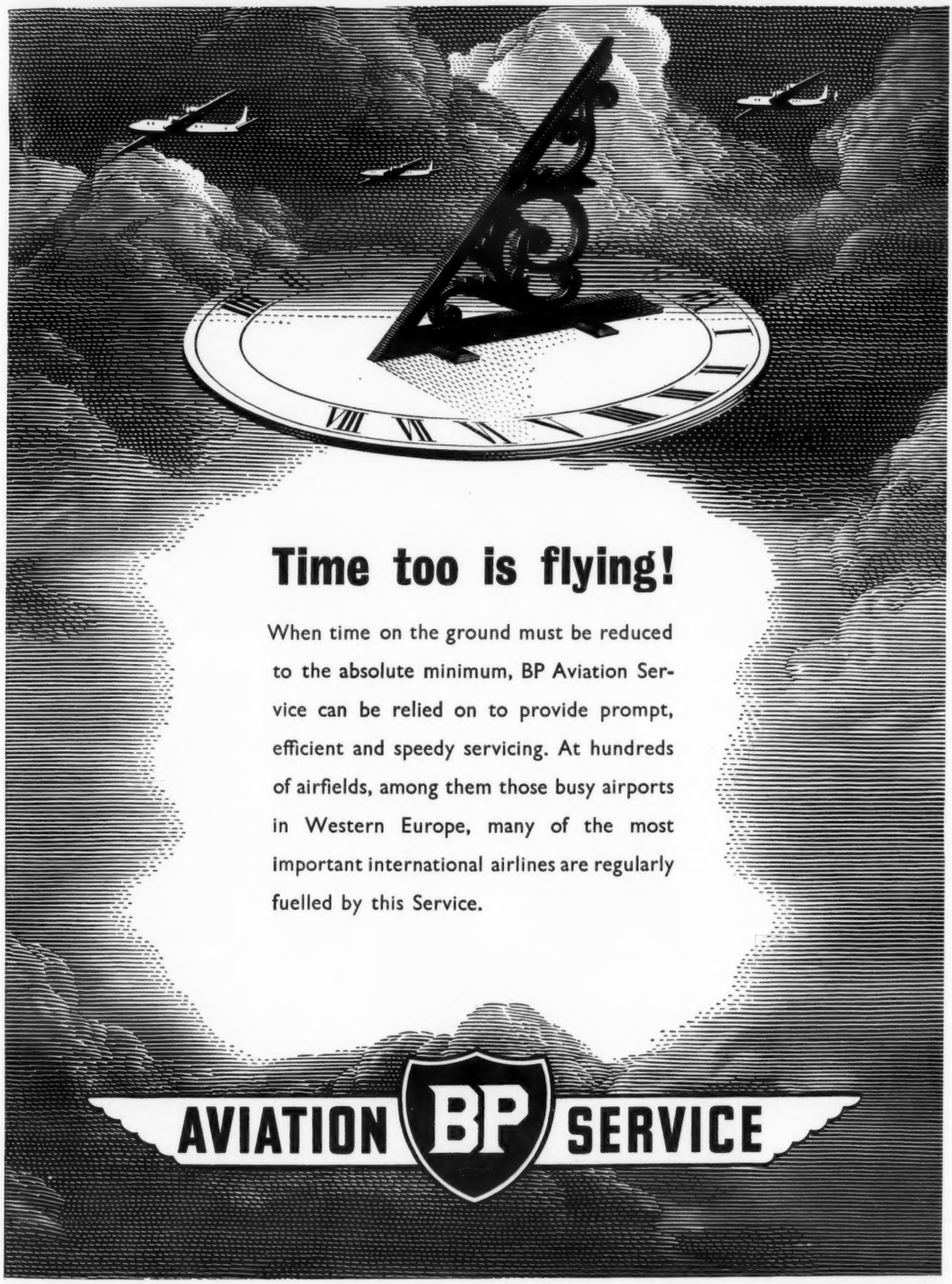

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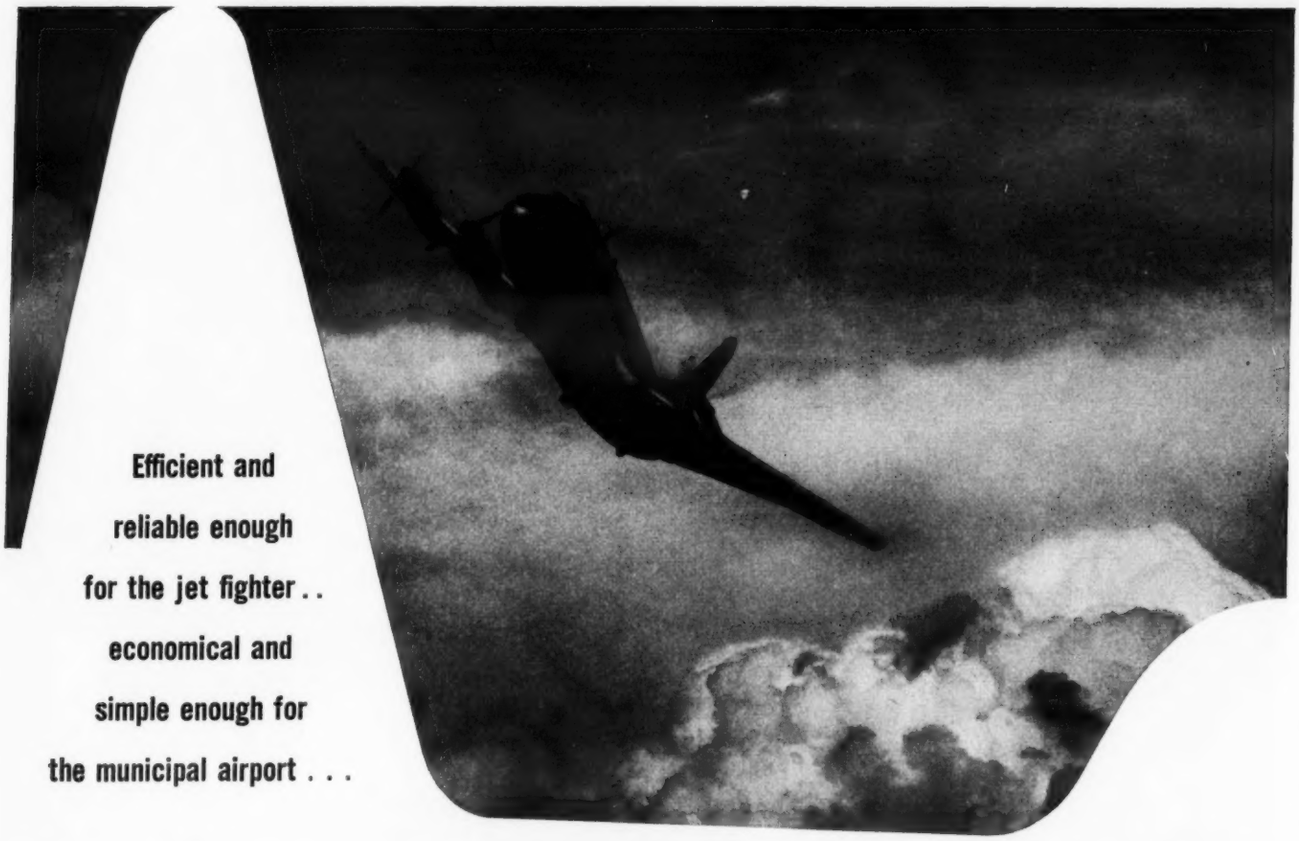

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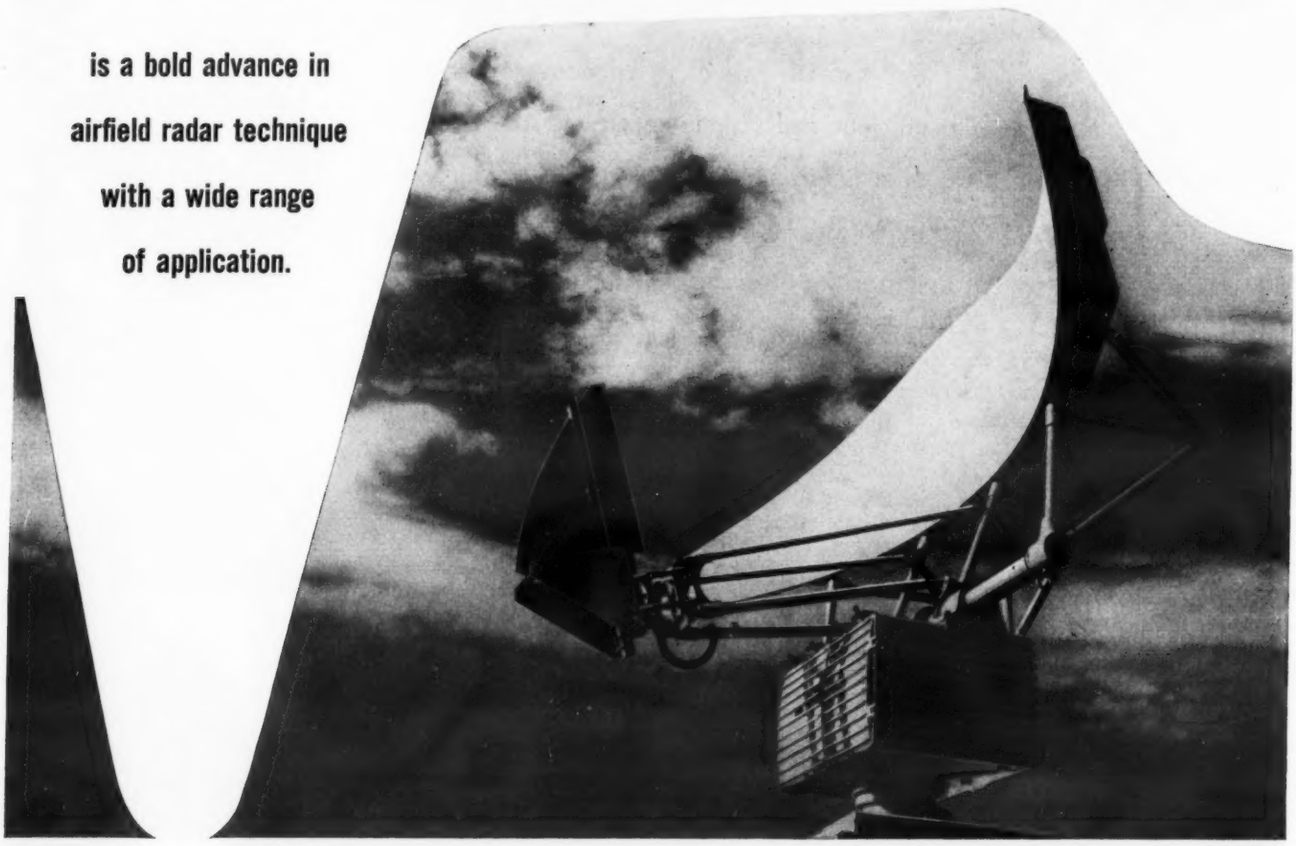

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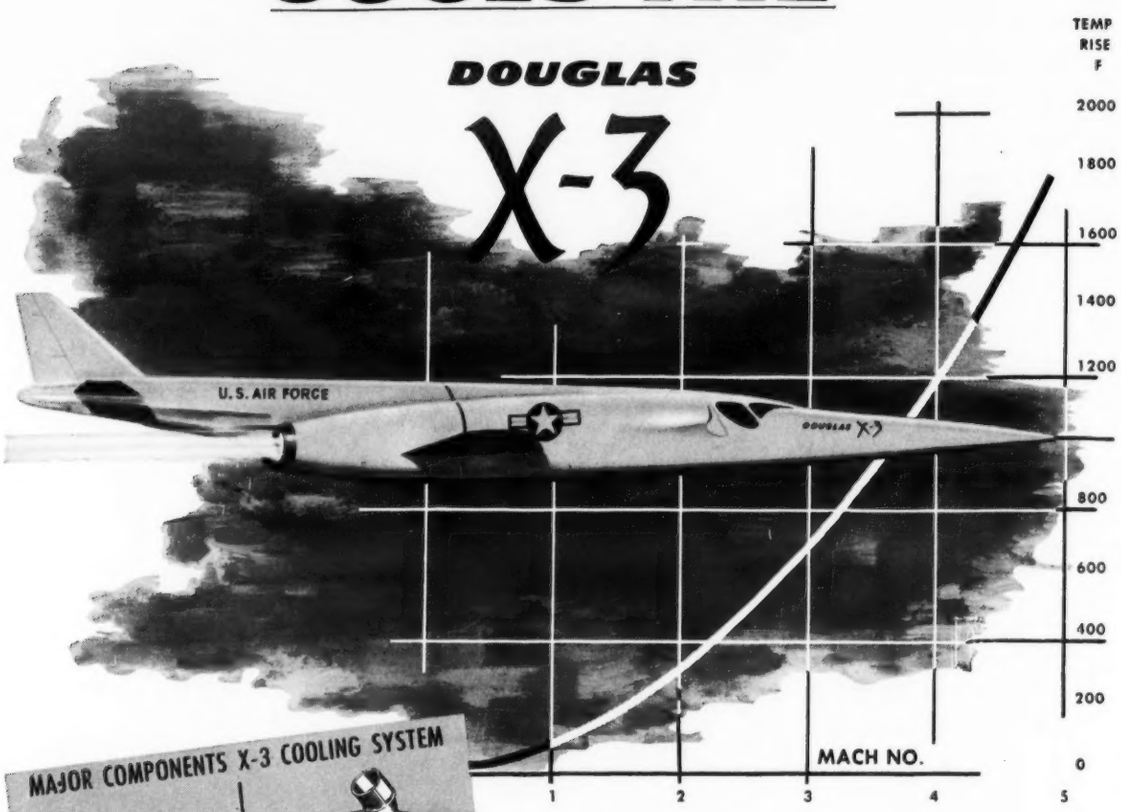
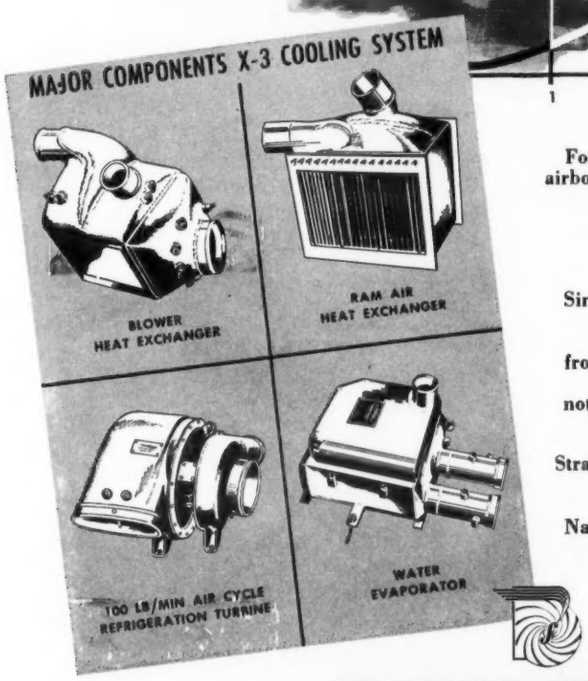
STRATOS COOLS THE

DOUGLAS X-3

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Stratos is proud to have been called on to design and produce equipment for this radical new research airplane built under the joint sponsorship of the Air Force, the National Advisory Committee for Aeronautics and the Navy.

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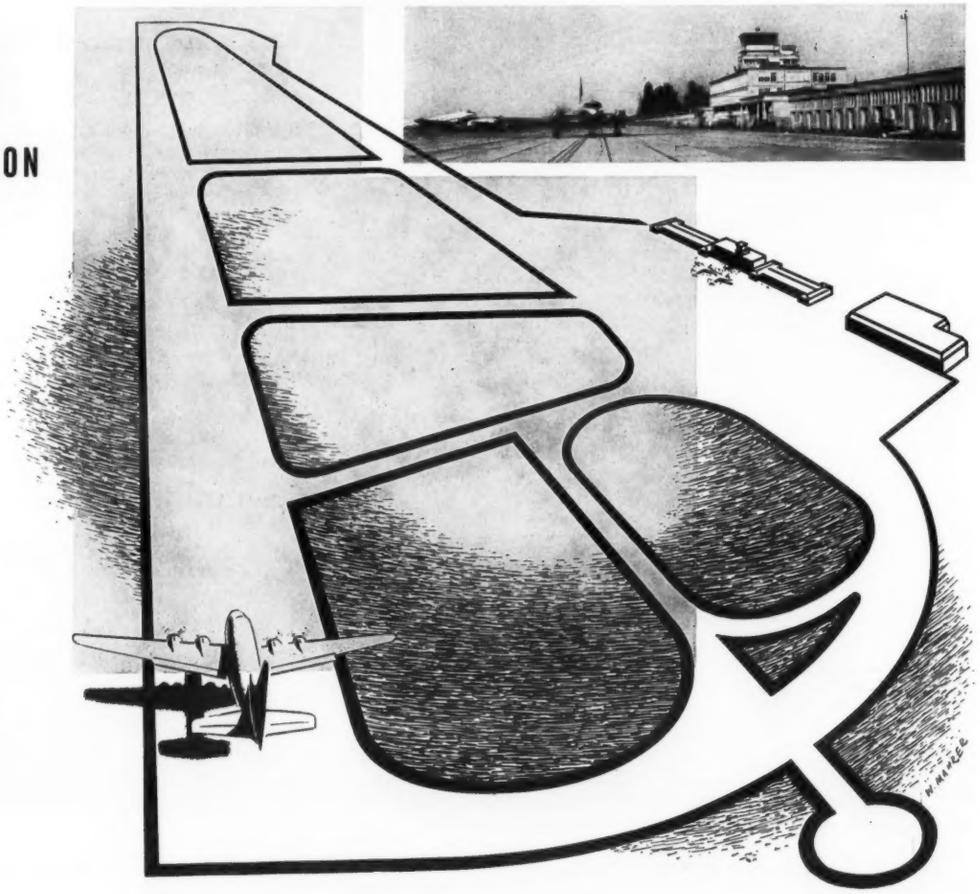

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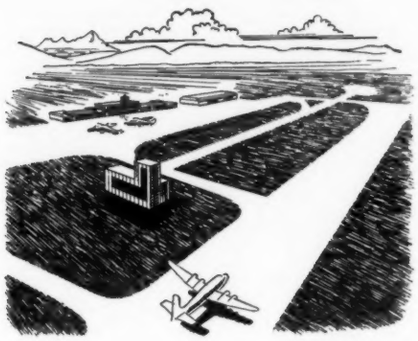

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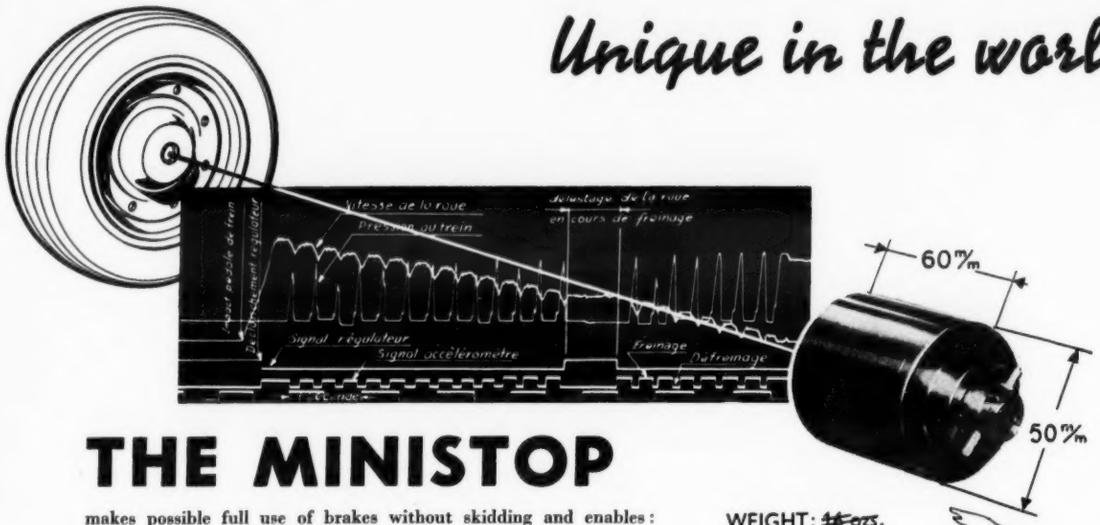

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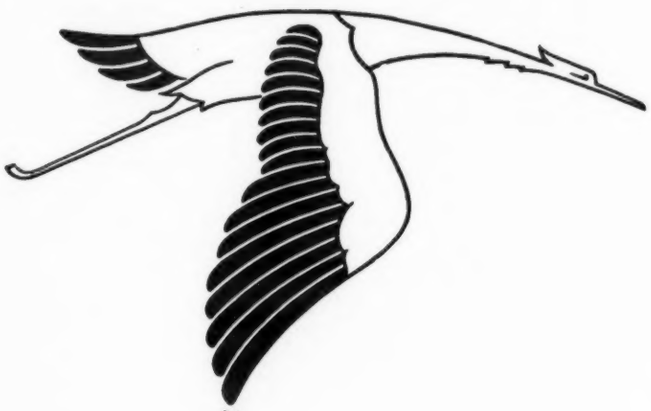

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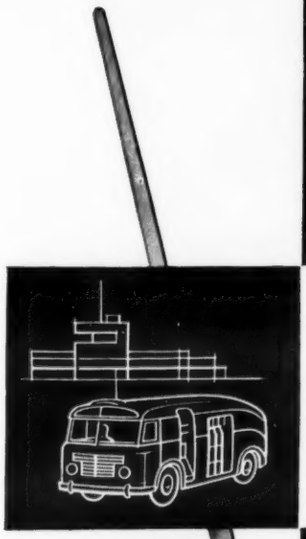

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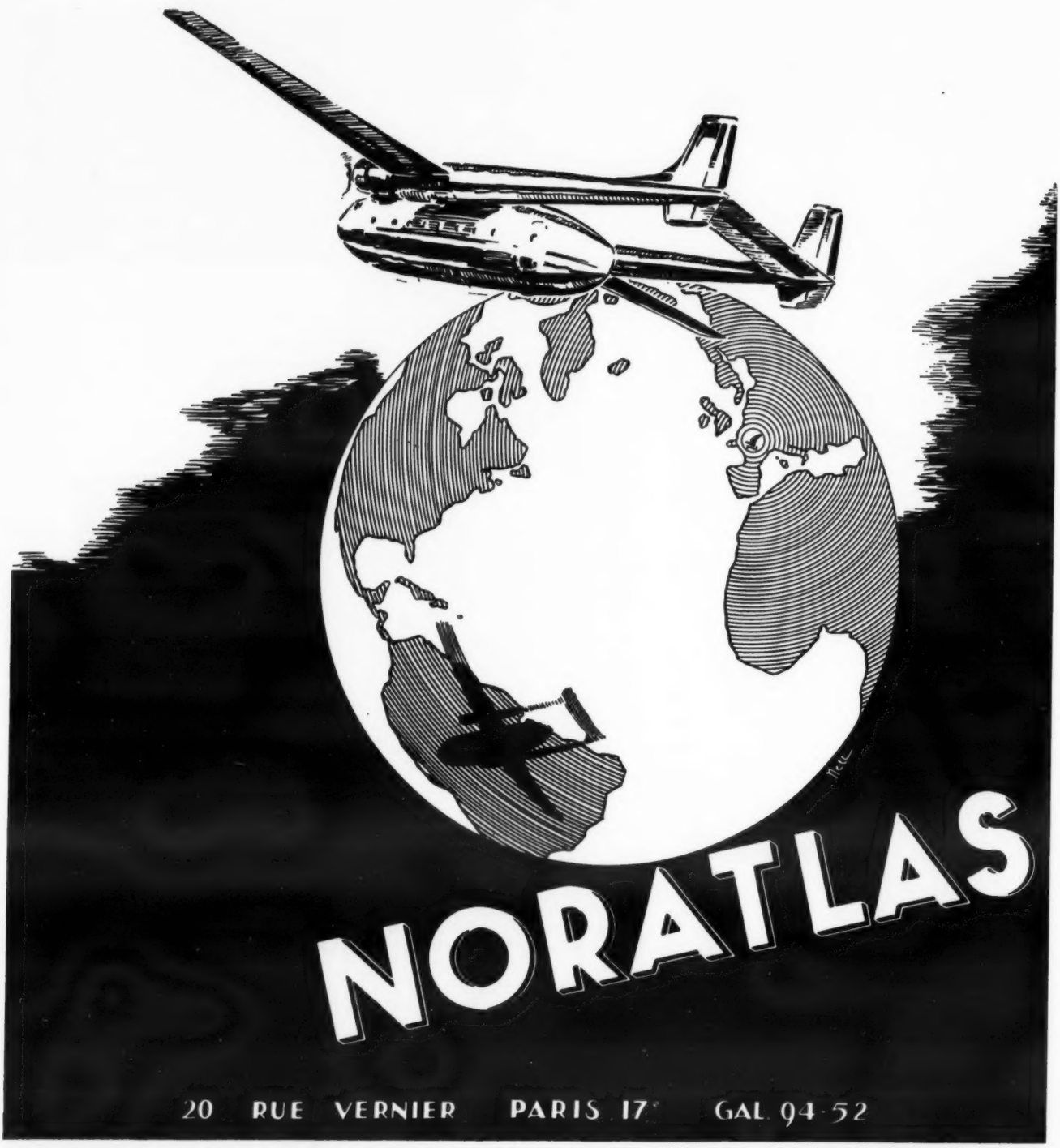

NORATLAS

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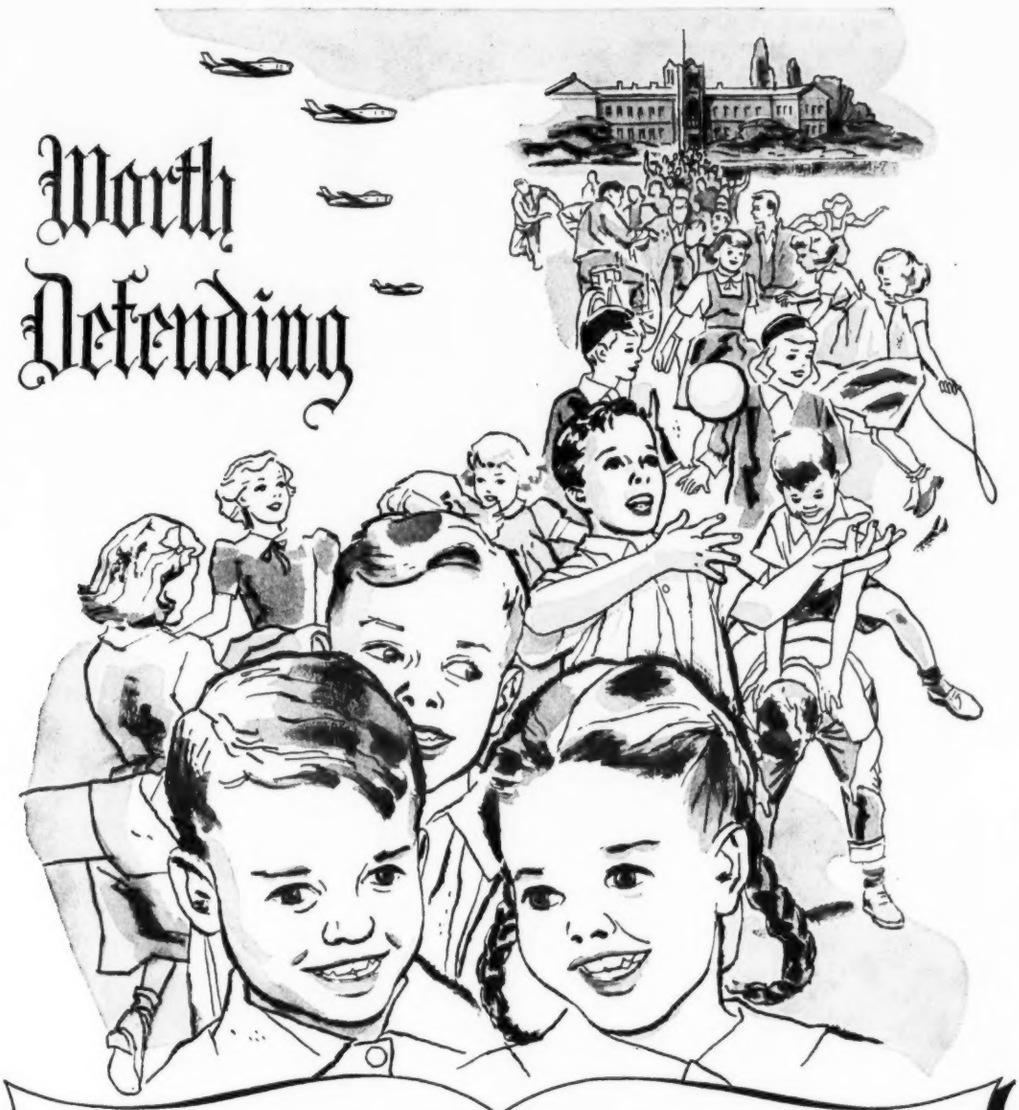

THE LIVES OF OUR CHILDREN . . .

. . . your children — our children — children of the nations of like minds to ourselves — happy, carefree children who look to us for their tomorrow.

What will that tomorrow be? What will *they* be tomorrow? Happy young people — happy useful citizens in a steady useful world — or the pitiful pawns of war, corruption and tyranny?

Their hopes can only be realized through our preparedness: the will and might to deter any who would harm our children, the determination that the freedom and peace our children deserve are *worth defending!*

CANADAIR
— AIRCRAFT MANUFACTURERS —
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One of a series dedicated to the survival of freedom — Reprints on request. — European Representative, J. H. Davis, Princes House, 190 Piccadilly, London, W.1, England.

Le Vautour

The speed of a fighter
The power of a bomber

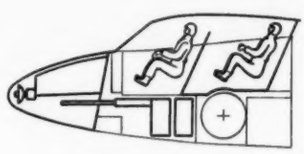
The VAUTOUR is being mass-produced in its three versions for the French Air Force

Comfortably exceeding the speed of sound, it is one of the fastest planes in the world in its category • The ease with which it can be converted permits economical standardization of manufacture and use • It can readily be equipped with any of the most powerful jet engines, such as the ATAR, AVON, SAPPHIRE • Owing to its large capacity and useful load, the VAUTOUR has a long flight endurance (several hours) and can carry a very powerful armament • It can operate from short or makeshift strips.

The VAUTOUR is the combat aircraft best suited to European needs

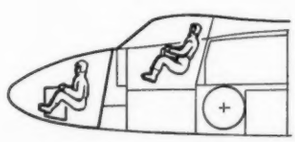
SNCASO

3 VERSIONS

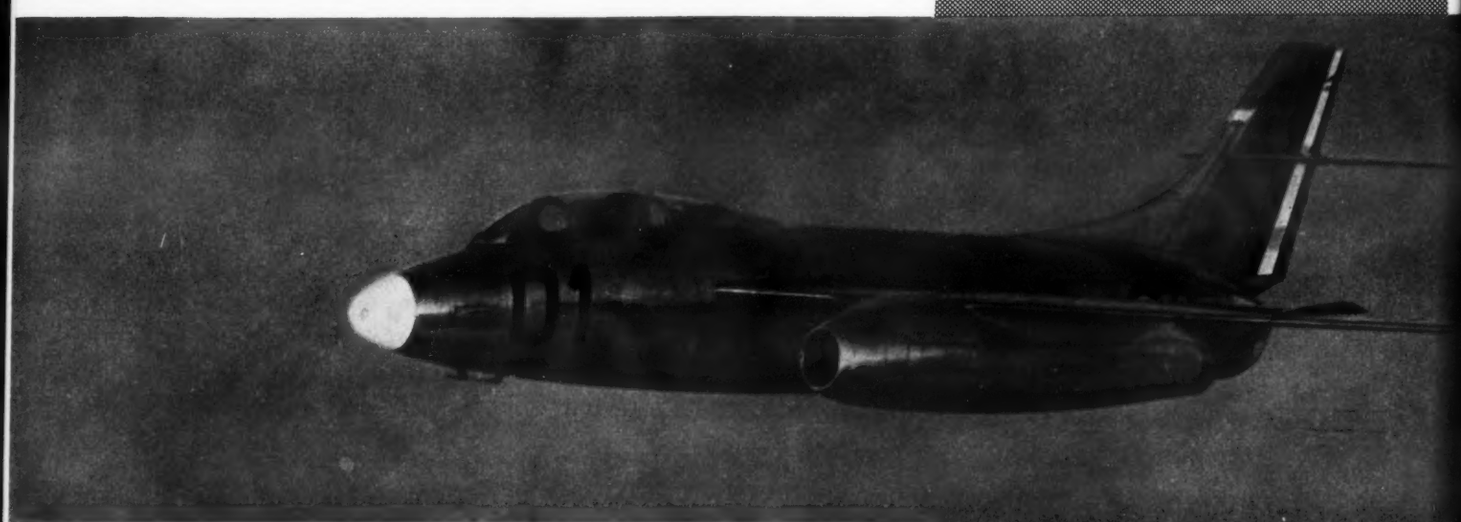


All-weather fighter

Ground attacker



Bomber



SOCIETE NATIONALE DE CONSTRUCTIONS AERONAUTIQUES DU SUD-O

105, AVENUE RAYMOND-POINCARÉ - PARIS 16e - Tél. KLEber 32-20

INTERAVIA

Deadline Notes

No. 2, 1954

U.S.A.F. UNAFFECTED BY BUDGET CUTS

The U.S. Air Force is not affected by the cuts in the military estimates for the 1954-55 fiscal year, beginning on July 1st, 1954. Total defence estimates are reduced from $48,700,000,000 in 1953-54 to $44,860,000,000, but the U.S. Air Force is to be increased during the year from 115 wings (with 21,000 aircraft) to 120 wings, with 22,900 aircraft. Within three years its strength is to be raised to 137 wings. Total aircraft strength of the U.S.A.F., the Navy and the Marine Corps is to be increased from 33,000 to 40,000, also during the next three years. U.S.A.F. manpower is to be raised by 15,000 during the 1954-55 year, although total strength of the three armed services will fall by roughly 400,000 men.

SWEDISH AIR FORCE ESTIMATES UP

The 1954-55 defence estimates submitted to the Swedish Parliament on January 12th, 1954 show only a small increase over the previous year, from 2,155,000,000 crowns to 2,180,000,000. However, the Air Force figure has been raised, at the expense of the Army and the Navy, by no less than 100,000,000 crowns, to 689,000,000 crowns. Distribution among the three armed services: Army 806,000,000 (40% of total defence expenditure), Navy 406,000,000 (20.1%), Air Force, 689,000,000 crowns (34.1%). - The remaining 5.8% are for the defence administration. Credits for the Air Force's seven-year procurement plan have also been increased by 100,000,000 crowns, so that urgent renewals of equipment can be made.

INTERNATIONAL CHAMBER OF COMMERCE AIR TRANSPORT MEETING

The Air Transport Committee of the International Chamber of Commerce held a meeting in Paris in mid-January, under the chairmanship of Dr. H.L. Slotemaker (K.L.M.), to discuss such questions as the revision of the Warsaw Convention (liability of the carrier to passengers and freight consignors), the forthcoming Strasbourg conference on the coordination of European air transport, questions of freight and mail transport. Personalities attending the meeting included Dr. Edward P. Warner, President of the Council of the International Civil Aviation Organization, Henri Bouché (member of the I.C.A.O. Council's Air Transport Committee), Dr. E. Pepin (Legal Director of I.C.A.O.), Max Hymans (President of Air France), John W.S. Brancker (Traffic Director of the International Air Transport Association).

U.S. NAVAL AVIATION REEQUIPMENT PROGRAMME

The reequipment of the U.S. Navy's aviation units is making rapid progress. Whereas in 1952 only 28% of the total of 13,400 Navy aircraft were of modern types, this percentage increased to 56% in 1953 (total number unchanged). - In the absence of an official definition of the term "modern" it is assumed that fighters will be jet models and piston-engined types will be post-World War II vintage.

U.S. ARMY SPEEDS UP AIR-BORNE TRAINING

Training of air-borne forces for the U.S. Army has been considerably speeded up since January 1st, 1954. The training school at Fort Benning (Ga.) now takes approximately 1000 students a week.

U.S. AIRLINES' CAPACITY ENLARGED BY 42%

U.S. scheduled airlines increased their carrying capacity by 42% in the three years between the end of 1950 and the end of 1953, the Civil Aeronautics Administration reports. According to F.B. Lee, C.A.A. Administrator, the number of aircraft has risen by only 194, but the number of ton-miles has grown by more than 1,000,000,000 a year, thanks to the use of bigger and faster aircraft types.

P.A.A. CARRIED 28% OF ATLANTIC TRAFFIC

Harold E. Gray, Executive Vice-President of Pan American World Airways' Atlantic Division, states that his company carried 127,130 passengers across the Atlantic in 1953, or 28% of all scheduled airline traffic between Europe and the U.S.A.

* From INTERAVIA's world-wide news service, including INTERAVIA AIR LETTER, the daily international aviation news digest. — No part may be reproduced without written permission.

AMERICAN AIRLINES ALSO REPORT RECORD FIGURES

American Airlines recorded 3,289,972,000 passenger-miles in 1953 - the first airline to pass the 3,000,000,000 mark in one year. The 1952 figure was 2,906,000,000. Tourist-class services accounted for 17.1% of the total (13% the previous year).

TRIUMVIRATE TAKES OVER MANAGEMENT OF K.L.M.

The Board of Directors of K.L.M. Royal Dutch Airlines announces that no successor will be appointed for the time being to the late Dr. Albert Plesman. The company will be managed jointly by F. van Balluseck, F. Besançon and M.J. van der Ploeg. The Foreign Relations Department will continue to be run by Dr. L.H. Slotemaker.

SOUTH AFRICAN RESTRICTIONS ON AIR TRANSPORT

General Riiser-Larsen, Scandinavian Airlines System's Regional Director for Norway, has gone to South Africa to discuss the restrictions placed on foreign airlines flying to the Union. The European companies involved (S.A.S., K.L.M., Sabena) are showing some concern over latest measures by the South African authorities. For example, S.A.S. has been instructed to reduce its services to one a fortnight, instead of one a week, from July 1st, 1954, and K.L.M. to cut its down from two a week to one a week. - South African non-scheduled operators, whose carriage of Dutch immigrants to South Africa is a lucrative business, are in turn showing some apprehension, lest European countries take counter measures.

JAPAN AIR LINES GETS U.S. PERMIT

Japan Air Lines has received authorization from the U.S. Civil Aeronautics Board to operate the Tokyo-San Francisco route. Services are scheduled to begin in February, using three Douglas DC-6Bs.

J.L. ATWOOD NEW I.A.S. PRESIDENT

J.L. Atwood, President of North American Aviation, has been elected President of the Institute of the Aeronautical Sciences for 1954, in succession to Charles J. McCarthy, Vice-President of United Aircraft Corp.

ATOMIC POWERED AIRCRAFT PLAN ABANDONED

Pentagon sources now indicate strongly that the military have virtually dropped plans for an atomic-powered aircraft. Interavia's Washington correspondent reports that the problem of shielding the reactor in manned aircraft has proved insoluble to date, despite five or six years' search for a suitable light material. The problems involved in atomic-powered pilotless aircraft and guided missiles are also proving insurmountable, because of the danger of lethal radiation if such an aircraft should crash, and because of the exorbitant cost. U.S. military experts are believed to be on the point of abandoning all work in this field for at least ten years.

*

WORKSHOP BRIEFS ...

A new two-seat experimental helicopter, the B-2, is being flight tested by Brantly Helicopter Corp. * According to American sources, launching tests have begun with the Bell Rascal and North American Navaho artillery rockets. * The Red Air Force's Ilyushin IL-28 twin-jet light-to-medium bomber has evidently been delivered to the units in considerable numbers. A swept-wing version is in quantity production. * An undisclosed number of North American FJ-4 carrier-based fighters has been ordered by the U.S. Navy. * Bell XV-3 is the type designation of a convertible aircraft under development at this firm. * Quantity production of the Convair B-36 ten-engined bomber is to be phased out during 1954. * The SFECMAS 1402 Gerfaut experimental delta-wing aircraft (SNECMA-ATAR 101B engine) made its first flight in mid-January. * The British firm of Fairey is working on the development of a pilotless remote-controlled version of the Firefly, the Firefly Mk.8. It is to be used as target aircraft. * A two seat trainer version, TF-86, of the North American F-86F Sabre single-seat fighter is being flight tested by North American. * Aerojet-General reports development of a new bi-propellant rocket engine for guided missiles. * Reports by the Armaments Research Establishment, Forst Halstead, Kent, reveal that the Establishment is working on a design for a new guided missile with special target-seeking head for use against under-water targets. * Douglas has delivered the last of the F3D Skyknight two-seat all-weather fighters to the U.S. Navy. * Glenn L. Martin is said to be working on a large jet-powered flying boat. * January 9th, 1954 was the tenth anniversary of the first flight by the Lockheed F-80 Shooting Star. * Latest versions of the Mikoyan MiG-15 are fitted not only with afterburners, but also with electronic sights and automatic fire control.

* * *

Outlook for 1954

What will this year bring to aviation? Observers everywhere agree that 1954 will be of decisive importance in many ways. East-West tension seems to be easing, the antagonists are on speaking terms again, there is talk about defence expenditure cutbacks. All this will affect aviation in many ways. To find out what these effects will be, INTERAVIA asked its Correspondents all over the world to sound out the situation. They talked to Government officials, industry leaders, airline executives. Following are their reports on what will happen during 1954 in the international aviation field and in some of the world's major air-faring nations. **-Ed.-**

International Aspects

Emphasis on Air Armament in State of the Union Message

The task of preparing his State of the Union speech to the Congress at the beginning of January must not have been easy for President Eisenhower. He was in much the same position as the writer of a leading article who on the eve of decisive events has to put down something concrete about the future. With Berlin getting ready for the Four-Power Conference on January 25th, could the State of the Union Message have been expected to be other than a somewhat colourless "either—or"?

Eisenhower's speech did indeed contain compromises, but only on the subject of American domestic and social policies. From the points of view of foreign policy and particularly defence policy the message was especially clear and unmistakable. Basically this is not surprising. The message was simply the logical extension of the West-East exchanges initiated on December 8th, 1953 by Eisenhower's atomic pool proposal to the United Nations and continued by the relatively conciliatory Russian reply of December 21st.

In their planning the Americans are allowing for the fact that the Russian possess atomic weapons—including the hydrogen bomb. Hence the *constructive peace proposal* of December 8th for an atomic pool, the coordination of the means of production in East and West; the utilization of atomic energy for peaceful purposes, under the supervision of an international authority. On the other hand the Americans announced on January 7th that, if no agreement is reached with the East, there would be mutual exchange of atomic information between N.A.T.O. countries, an increase in American arms aid to the free world, a decisive strengthening of the U.S. Air Force and naval aviation (at the expense of the other armed services; cf. the forecast of the 1954-55 defence estimates elsewhere in this issue), expansion of civil defence in the United States, though with emphasis on the principle that the best form of defence is attack. In addition America would stand by the North Atlantic Treaty, the European Defence Community and the participation of German forces in the defence of the West.

Europe and the strategists

Early in January *General Alfred M. Gruenther, Supreme Commander, Allied Powers in Europe,* gave the European members of N.A.T.O. a testimonial: *more progress had been made* since the creation of N.A.T.O.'s Paris headquarters in January 1951 *than could have been hoped.* Defence appropriations under European budgets had grown from $ 5,500,000,000 to $ 11,600,000,000 within three years. In 1951 N.A.T.O. could call on only 1,800 aircraft and 15 air bases (most of them unsuitable for jet aircraft); today it has 120 bases (all utilizable by jet aircraft).

President Eisenhower has worked out a comprehensive programme for international collaboration.

*

Far more critical is the view of a leading French Air Staff officer, who points out the strategic dangers of Europe's small-state organization.

"The political aspect of the European Defence Community has been discussed at length, and the pros and cons have been argued on both sides of the frontiers, but much less attention has been paid to its true objective, its military aspect . . .

"A German contribution seems more and more desirable, as the rest of the world has reached its limits. But, if the problem of defending Europe against an attack from the East is examined, it will be seen that German troops and German aircraft are, fundamentally, much less important than the abolition of frontiers in a corner of Europe obviously too politically divided to have any chance whatever to defend itself or to be defended effectively in this age of atomic weapons and transonic speeds . . . Since Western Europe can today be crossed in less than two hours of flight, its frontiers mean nothing when it comes to defence (or even to its economy, which is crippled by the restrictions of national markets).

"This strictly military aspect is especially serious. It is obvious that, unless European countries pool their resources, through the European Defence Community or some other means, and do away with their frontiers so as to keep pace with the rapid evolution of armaments, their military future is at an end. It was already seriously compromised in 1945. Air defence (impossible without depth), ground operations (impossible without deployment of combat and logistics forces over several hundred miles), design and production of armaments (impossible without pooling of technical and financial resources), development of nuclear explosives (out of reach without an atomic pool); all these things are impossible to European countries taken singly. This is a direct threat to their future."

*

In fairness, it must be admitted that European industry has already recognized the need for cooperation. The formation of the International Association of Aircraft Manufacturers is a welcome step towards the unification of European research, development and production.

The outlook for air transport

According to figures published by the International Civil Aviation Organization, the world's airlines carried roughly 52,000,000 passengers during 1953, compared with 45,000,000 in 1953 and 39,900,000 in 1951.

Sir William P. Hildred, Director General of the International Air Transport Association, estimates that there will be another increase of 10% in passenger volume during 1954. However, he warns that there can scarcely be a corresponding increase in revenue, for the following reasons:

In order to attract new categories of travellers, rates had been cut substantially. The latest I.A.T.A. Traffic Conference (in Honolulu, November 1953) had decided that tourist-class service should be extended to long-distance routes practically throughout the world in 1954. Tourist rates have been cut to the bone, and the profit margin has become very modest. In addition, air mail payments had been greatly reduced in most countries during 1953. Finally, in order to be able to handle the increased passenger volume and meet modern requirements airlines had to purchase new equipment. It is expected that 300 new aircraft will go into service on the world's air routes in 1954, which will increase the present commercial fleet by about 10%.

In view of growing operating costs and rising wages, it may be assumed that *the airlines' financial situation in 1954 will be more precarious than in recent years.* Companies will therefore have to observe the strictest economies and make real efforts to reduce expenditure.

U.S.A.—Best year of all

Washington and Los Angeles, January.—**Barring economic or military catastrophe—neither foreseeable at this time—the United States should enjoy 1954 as the best year in its aviation history.**

There can be little doubt that the nation will maintain its leading position in international aviation affairs—competitively strong in international air commerce; dominant in military air strength and potentially capable of holding in check threats of a new "world war"; a strong bidder in world markets for orders covering aircraft and aviation accessories so far released only in limited quantity to non-domestic civil and military purchasers.

Airframe manufacture will reach its post-World War II peak during this year, and military aircraft sales, which will represent probably 95 percent of the nation's production, should reach or exceed a valuation of eight billion dollars.

Airline traffic is certain to make new gains. Major scheduled airlines, all prosperous, will receive impressive deliveries of new planes ordered during the past two years; will expand domestic routes and make further inroads upon the business of surface passenger carriers.

Military air power will be heightened by a rapid increase in the rate of all-jet conversion of both fighter and bomber wings, and by the close of the year all first-line airplane bases, both on U.S. soil and on that of friendly nations, should be fully jet equipped.

The Boeing B-52 — last of America's giant bombers !

There is good reason to believe that the production rate of momentarily "standard" jet fighters, medium reconnaissance bombers, and heavy bombers will exceed—unless the need becomes unexpectedly urgent—Air Force requirements and that the nation will become a more-than-liberal supplier of military jet equipment (heavy bombers excepted) to all nations in alignment with American mutual defence policies.

An aura of political good will seems to extend toward U.S. manufacturers and airlines alike from the Eisenhower Administration, and in air commerce there will be strong encouragement for the extension and strengthening of the international services of domestic carriers. *To this end an appreciably less liberal attitude toward foreign flag lines entering the United States may be evidenced and even given diplomatic support before the year ends.*

It is extremely unlikely that United States aircraft and accessories production, the core of aviation prosperity, will experience any significant decay during the present year. Production employment will not reach its peak until mid summer or early fall, and decline from the peak will be moderate, in some companies almost negligible, during the closing months.

*

The armistice in Korea has made no difference in America's military aircraft production program. The cutbacks in production of familiar types are now revealed to be only a rearrangement of funds in favor of new, more advanced types of aircraft. And guided missile production, so long awaited, will become a reality.

It will be recalled that upon taking office early last year, Secretary of Defense Charles E. Wilson indicated abandonment of the 143-wing Air Force program towards which the preceding Administration had been building for three years. It was Wilson's argument that since only enough aircraft could be delivered during 1953 to equip a 120-wing Air Force, then that should be the size of the program—nothing more. The Air Force now has about 110 fully-equipped combat wings and will attain the 120-wing strength by the end of the current fiscal year next June 30.

Under the military production "stretch-out" program the *manufacture of several types of jet combat aircraft will end during the year. However, the industry's loss of this activity will be balanced by a step-up of heavy bomber production,* spread throughout the industry in the form of component production contracts, and the realization of full production of fighter and other designs which were in process of tooling up last year.

A signal event of the year will be the end of production of the Convair B-36, which many soberly believe to have been a major deterrent to war during the past eight years. There has never been any serious question—even in Moscow—of the ability of the B-36 to hit that capital with an atomic bomb under proper circumstances. The end of B-36 production means nothing to its continuance as a prime weapon of the Strategic Air Command for several years to come. But it marks the end of the 30-year effort in the U.S. to produce ever-larger "giant" bombers operating under the rigid rules of the Breguet range formula.

The Boeing B-52 *Stratofortress* is, of course, a superior weapon to the B-36. It is already nearing quantity production and will replace the B-36 in Strategic Air Command squadrons beginning in 1955. Freed of the critical requirement of carrying a great weight of bombs by the virtually negligible weight of the atom bomb—or bombs—the B-52 has converted this weight to fuel for its doubly-thirsty jet engines and thus preserved the 10,000-mile range requirement of the U.S. strategic bomber. Just how much fuel is required to feed eight 10,000 lb. thrust turbojet engines for 18 to 20 hours can be seen from the fact that the B-52, ready for an intercontinental mission, will take off at a gross weight of 376,000 lbs., the greatest weight ever lifted into the air. For this reason the Air Force is already saying the B-52 will be the last of the "heavies".

Instead, U.S.A.F. procurement planning is already moving towards the fast, medium bomber for "perimeter" assignments. Queen of this new group is the Convair XB-58 *Hustler*, already being referred to as a supersonic bomber, although engineers don't believe we are ready for anything more than high subsonic speeds in a bomber at this time. Meanwhile, Strategic Air Command is becoming increasingly equipped with the completely-proved Boeing B-47 *Stratojet*, of which more than 200 are now in service. This medium bombardment force—with atomic bombs—is certainly a large measure of threat to Moscow from bases in Europe and Africa.

U.S. Naval Aviation already has its required 16 carrier air groups and its only procurement program for the present is to continue its rapid conversion of these groups to modern aircraft. Current standby in this program is the Grumman F9F-6 *Cougar* swept-wing jet fighter with a performance roughly the equivalent of the North American F-86 *Sabre*. Joining it on the carriers is another airplane with performance identical to that of the *Sabre*, the North Ameri-

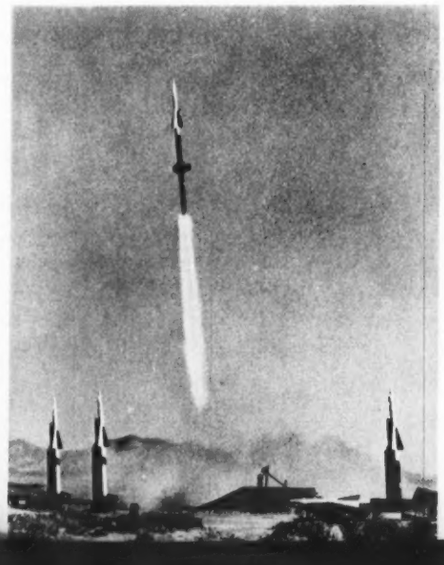
can FJ-2 (and FJ-3) *Fury*, which is, in fact, a *Sabre* for carrier use. Both of these types were in quantity production during the past year and several hundred are now on hand.

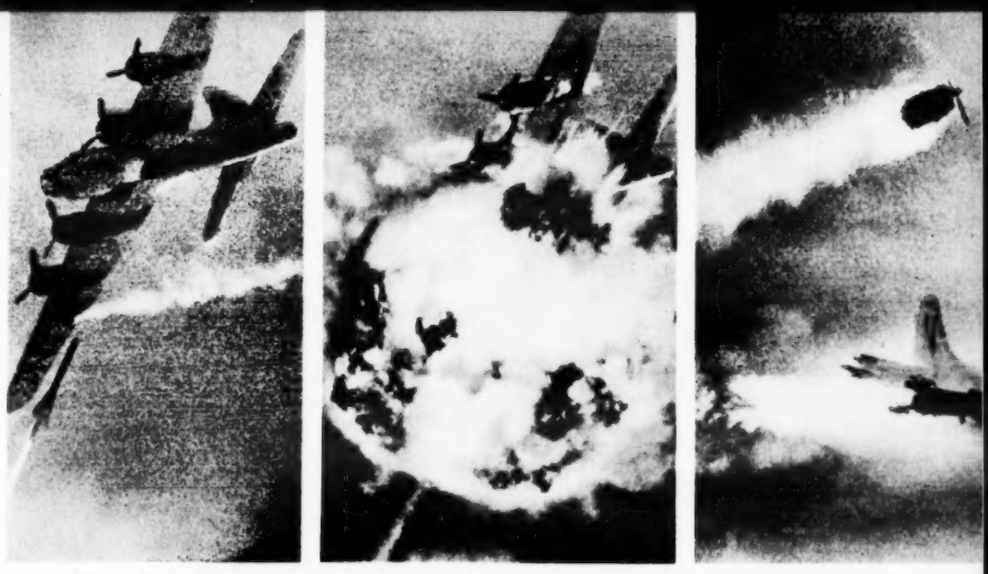
Most promising, however, is the Douglas F4D *Skyray*, already in production for the Navy's carrier groups. The F4D is, of course, almost a "one shot" interceptor and is purely an air defense weapon for the carrier task force. The Navy finally gave up its concerted and sustained effort to get the turboprop-powered Douglas A2D *Skyshark* into satisfactory form and has now turned its attention to the twin-engine Douglas A3D for carrier bomber service. The first production airplane has already been delivered.

Consensus of Washington opinion is that the U.S.A.F. will receive an appropriation of about $13,000,000,000 in the Eisenhower budget for the fiscal year 1955 which begins on July 1st, 1954. This would represent an increase of about $ 2,000,000,000 over fiscal 1954 and would be needed to produce a *fully equipped Air Force of 137 wings plus a variety of supporting units by 1957.* One thing seems certain at this writing: the Air Force budget requests, regardless of the exact figure, will receive *little or no opposition in Congress this year;* this branch of the armed services has Congress in a mood to write virtually a blank cheque—in line, of course, with the overall national budget for all Services. An important point is that this 137-wing program will largely specify such aircraft as the North American F-100 *Super-Sabre* supersonic fighter and the Boeing B-52 *Stratofortress* intercontinental jet bomber, both believed to be superior to corresponding types anywhere else in the world.

Air Power enthusiasts used to accuse the Truman Administration of "splitting the pie three ways", i.e. providing nearly equal funds for the Air Force, the Navy and the Army. The new Republican Administration condemned this practice. But it now appears they will follow the same practice in a modified form: make severe cuts in the budget request of two of the branches each year while giving the third all that it wants. Thus, at the end of three years each of the services will have received just about the same as the other two.

Shift to air defence. Combat-ready *Nike* A.A. guided missile stations will be established this year.





Nike guided missile in action against a B-17 target drone. *Left:* the missile flashes towards the bomber; *centre:* explosion following *Nike's* contact; *right:* the aircraft disintegrates.

One of the big disappointments to aviation observers was the long-awaited "new look" study of the new Joint Chiefs of Staff (under Admiral Radford). It may now be revealed that this new study contains no numbers, i.e., the recommended number of combat air wings, carrier air groups or ground forces divisions, but deals only in the generalities of providing the nation with an adequate defense. Therefore, it will offer the aviation-minded no ammunition in their argument for more and more air power. Instead, there will be endless—and pointless—debates on such dialectically unsound questions as "how much is enough defense?"

A strong shift to air defense is noticeable throughout the plans and programs being discussed in Washington these days. At least six of the new air wings being planned are for the Air Defense Command. The spirited discussion of radar early warning systems across the Canadian frontier of the United States—much of which is already in being—has been thoroughly publicised. The Lockheed "radar picket" version of the *Super Constellation* (known in the Navy as the WV-2 and in the Air Force as the RC-121 D) is in quantity production. The Northrop F-89 *Scorpion*, despite continuing difficulties, will remain in production throughout the year, and the North American F-86 D *Sabre* single-seat interceptor is in vast quantity production.

As the year ended the Army announced the *Nike* missile as being in large quantity production and that its *first combat-ready installation had already been made in the environs of Washington, D.C.* Other strategically-important centers (New York, Detroit, Seattle, Los Angeles) are receiving similar fully-manned batteries. The *Nike* is a radar-homing surface-to-air anti-aircraft missile of demonstrated accuracy and capability. It will be built in quantities numbered in four figures and is, in the Free World at least, the first anti-aircraft missile to go into active service at fully-manned defense posts. Introduction of the *Nike* this year is an indication that other missile designs—some of them possibly of intercontinental range, may be nearing quantity production.

It is quite probable that military proposals for mass production of interim missiles—winged drone aircraft carrying atomic warheads to targets and directed either by target-seeking control or by remote radio control—will be justified dollarwise if the United States goes ahead with an air drop of a hydrogen bomb in the Eniwetok-Bikini area in the spring. No disclosures have been made of the H-bomb drop technique. But it seems certain that if the bomber crew and plane are to survive the shock wave, the bomb will have to be delivered to its target aboard a radio drone and from a mother plane launch fifteen to twenty miles distant. The launching bomber doubtless will be a B-36; the "missile" a pilotless jet fighter radio-directed from the bomber.

What effect will this muscle flexing, and hint of mysterious new things to come have upon American international aviation affairs? Continuation of a big military production program doubtless will be cause for both fear and jealousy among other nations, and a feeling in some quarters that Uncle Sam may be assuming a role of world air weapons merchant. American history would indicate that while such reactions may result, they will be but an unfortunate sequel to the basic objectives of building a stout wall against a Russian air attack, and maintaining the health of a manufacturing industry which has become a major employer of U.S. manpower and a factor in the national economy.

Fiscal 1955's strong aviation budget illustrates the inclination of defense planners and policy-makers toward recognition of air power as a principal defence item and catalyst in the chemistry of physical and diplomatic peace.

This is not to imply that the United States may be expected to flaunt her increasing jet air power throughout the world during the coming months. *Actually, the year may show as it progresses a reduction of U.S. air units abroad, and even a surrender of some foreign soil air bases.* At the same time, however, there should be a pronounced

U.S. manufacturers will deliver 222 commercial transports in 1954, including about 100 Convair 340 Convair-Liners (above).

increase in the activity of U.S. fighter and bomber wings which continue to operate from key foreign bases; an impressive showing of the flexibility of the country's jet-equipped air units.

*

At the same time, the military and aircraft manufacturers are engaged in setting the stage for a major campaign implying that today's production line military jets are obsolescent, or soon will be so rated in the light of new weapons which can be made available on short order, or which require additional research to bring them to the point of tactical testing.

Individual airframe companies are rushing to completion new research facilities representing the investment of millions of dollars. Governmental aviation research centers are being expanded.

Major Yeager's 1,600 m.p.h. rocket plane fighter has aroused new speculation on the proximity of the manned rocket fighter as a production item. Douglas Aircraft's weird X-3 was brought into public viewing last December at a time when it might well serve as an influence upon 1954 research in new aircraft shapes for future production.

Air force is rushing completion of a new 15,000-ft. runway at Edwards Air Force Base, and has announced that the warmup ramps will be 19-inches thick—solid concrete. Doubtless in preparation for the testing of heavy intercontinental bomber designs not yet made public, which may be nuclear powered.

Before budget making is well under way *a number of new aircraft models will be flown and tested* to the point where they can be offered as designs for immediate production——the long-discussed light-weight jet fighter; new jet trainers; Lockheed's military air freighter.

The U.S. aircraft manufacturing industry produced about 12,000 military aircraft during 1953, of which about 6,000 were jet-powered. It turned out about 4,700 civil aircraft of all types. Employment at year's end was about 750,000 men and women. Several companies now employ more people than at their World War II peak, reflecting the fact that a greatly reduced volume of today's complex aircraft requires a World War II level of production workers, *thus foretelling some of the foreboding facts about manpower requirements for a possible World War III.*

Admiral De Witt C. Ramsey, president of the influential U.S. Aircraft Industries Association, estimates that military production will rise to 1,000 planes a month, and then taper off to a year-end production rate somewhat below today's sub-peak production. He believes that commercial transport production also will be in decline toward the close of the year. These two factors suggest that 1954 will see the industry facing a crisis in production *policies.*

From all indications it will be a year of effort to reserve the basic manufacturing strength and manpower of major airframe plants and key suppliers. To this end, when the production peak is passed, *there will be a falling by the wayside of the industry's "little people," the subcontracting manufacturers of aircraft components. Major companies will withdraw work from the shadow factories and bring it into their own plants.*

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Commercial aviation in the United States is entering a year which will combine both prosperity and strife, and forecasters for the nation's trunk airlines anticipate an even better year than they had in 1953, when they tallied 14,000,000,000 passenger-miles and boasted a passenger-miles gain of just under 18 percent over the previous year. Growth in 1954 will continue, they feel, although not at the 1953 rate.

Although their growth rate may modify this year, the major trunk carriers will have good cause to consider 1954 their "best year" if they are successful in bringing to a favourable climax their *war against non-scheduled coach service carriers.* Their efforts to force the Civil Aeronautics Board into rulings which would drive the Johnny-come-lately carriers out of business should reach a point of decision by mid-year.

The decisions of the Board in this competitive battle will be particularly interesting inasmuch as they will re-define the nation's internal air transport policy. Broadly expressed, the United States up to now has countenanced, as fostering healthy growth, intrusions upon what old-line carriers considered to be their inviolable certificated domain. C.A.B., after a long fight, allowed the creation of independant feeder airline services, which the trunk carriers considered an illegal intrusion. Similarly, the Board smiled upon the appearance of irregular passenger and freight carriers, and has seen them prosper to the point where they now are factors in air commerce and requiring — according to the point of view — either paternalistic certification or dissolution as illegal trunk competitors. *Should C.A.B. hold for the old line carriers, and eliminate the newcomers from both domestic and overseas competition, the decision will amount to a sharp reversal of U.S. commercial air policy.*

While final figures are not yet available, it probably is a safe guess that U.S. airlines will receive between 80 and 90 new Douglas, Lockheed and Convair transports. Combining domestic and foreign deliveries, the three manufacturers have scheduled a total production of 222 commercial airliners for 1954, in contrast to 243 transports delivered in 1953. Convair, who delivered 140 Convair Liners in 1953, will deliver around 100 this year. Douglas, who delivered 75 transports last year, will deliver 82 this year. Lockheed will be attaining a production peak for commercial *Super Constellation* deliveries this year, producing 40 of these transports in contrast to 28 delivered last year.

The introduction of scheduled, non-stop, transcontinental air service in the United States late last year ushered in a long-awaited new era in air transportation and a dream come true for many pioneers. As the Douglas DC-7 comes into service, it is setting new inter-city records everywhere it goes. Without disparagement, aviation experts everywhere—including the Douglas Co.—have been surprised at the substantial performance improvement in this 10-year-old basic design resulting from use of the Wright Turbo Compound engine.

The first flight this summer or early fall of the Boeing 707 turbine-powered transport prototype is giving airline heads the increasing jitters, since its scheduled flight date looms as something of an Armaggedon for U.S. airlines and rival manufacturers as well. On that date there will be a U.S. jet transport in being, but as yet there is little assurance that 1954 will bring into actual production any American jet transport. The latter part of the year will be spent in extensive testing of the Boeing. U.S. plane builders and airlines will be watching the Boeing jet closely, and there exists the bare possibility that its performance will be so superlatively good that commercial orders will result, and that the Seattle company's competitors will be induced to shelve their turbo-prop interim transport programs and launch an all-out jet transport production race.

Washington insiders are now saying that criticism of the Civil Aeronautics Board, which recently mounted to the White House, has now diminished considerably and that the agency will remain intact, at least for the time being. This means, in turn, no foreseeable eruptions in the airline route or tariff pictures. "*First class mail by air*" will be extended to the West Coast during 1954 and this revenue should put an end to the sensitive subject of "subsidy" for scheduled airlines in their domestic operations. The introduction of international tourist schedules should also diminish if not end subsidies for these opera-

tions. Should both of these happy events occur, the Board's most critical function will cease and, with it, most of the criticism.

In sum, then, there appears not the slightest cloud on the horizon of U.S. aviation during 1954—the first year in many when such a statement could be made.

CANADA—Excellent and getting better.

Toronto, January. — **Although the details of Canada's closely-guarded defense budget will not be released for several months, there are strong indications that the R.C.A.F. will be given even more money than last year, mostly for North American defense. In 1953 the R.C.A.F. got 41.7 percent of the $2,000,000,000 defense budget, as compared with 37.6 percent the previous year. In 1954 the R.C.A.F. may receive as much as half the budget, or around $1,000,000,000.**

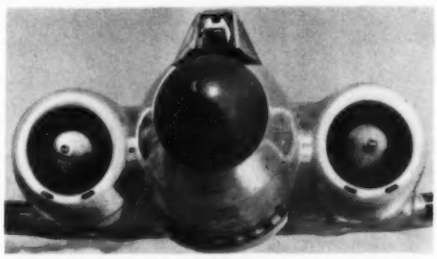
The *three-year defense program* costing some $5,000,000,000, which was intended to build Canadian military strength to meet any emergency and was inspired by the outbreak of war in Korea, is drawing to a close. The aim was to have some *41 R.C.A.F. squadrons with a total personnel of 50,000 equipped with 3,000 new planes*, mostly Canadian-built. A self-sufficient industry at a state of readiness was to back up the striking or defensive forces.

Since beginning the programm, Canada has accepted new commitments. *Technological advances have been made which have increased military efficiency but have also added to the cost of the equipment, and the time required to produce it. The three-year program has been changed to a four-or-five year build-up, and the over-all bill will be considerably in excess of the original estimate.* Nevertheless, as Canada nears the end of the original three-year period, she finds that some parts of her program have been completed. Others are nearing completion, and the remainder are well under way.

To date, the Canadian Department of Defense Production has placed orders for some $4,000,000,000 worth of weapons and equipment required to increase Canada's strength, some 60 percent of which is for the R.C.A.F. or for ships and construction. The amount spent for delivery of end items is more than $2,600,000,000, indicating that there is a substantial volume of work still to be completed.

Canadian defense authorities are agreed that Canada has reached the peak of its defense program and is now levelling out. This, of course, assumes no worsening in the international situation. After the program is completed, however, it is estimated *it will cost Canada $900,000,000 a year to keep her guard up.*

R. M. Brophy, Canadian Deputy Minister of Defense Production, says: "There is a certain irreducible minimum below which our defense expenditures cannot go. A certain level of defense preparedness must be maintained to keep our own establishments in operation and to meet our international obligations. In addition, we are always faced with the problem of obsolescence and, in view of the tremendous technological changes taking place in modern warfare, there will undoubtedly be a fair amount of replacement to keep our military machine up-to-date."



The R.C.A.F.'s standard long-range all-weather fighter is the Avro-Canada CF-100 *Canuck*.

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The Canadian aircraft industry will not take long to meet the requirements of the R.C.A.F. Steps are therefore being taken not to let essential production lines become completely dissipated, which would mean that Canada would again be in the position it was in prior to Korea.

The major measure in this connection is the Canadian Government's plan to *introduce a $1,000,000,000 production schedule to keep the country's aircraft manufacturing facilities in operation until about 1960.*

As a result, the Canadian aircraft and engine labour force of approximately 60,000—which includes repair and overhaul personnel—is expected to remain fairly constant for at least six years. *Chief beneficiaries* of the program are Avro-Canada, employing about 14,000 persons; Canadair, employing 11,000; The de Havilland Aircraft of Canada, Ltd., 2,200; and the Aircraft Division of Canadian Car & Foundry, 1,600.

One of the means to be employed under the program to keep production lines operating at optimum economic levels will be to make full use of the *Mutual Aid Program.* Canada is paying $324 millions a year for mutual aid, mostly for armaments and munitions; she also supplied 375 Canadair-built North American F-86 *Sabre* fighters to the R.A.F. months in advance of the date originally planned (the U.S.A. is paying about 30 percent of the cost of these); she will furnish P&W *Wasp* trainer aircraft engines; 300 secret mobile radar units; and training for 1,400 N.A.T.O. aircrew a year.

The Canadian Government is also taking steps to ensure that, if a production line is shut down, it will be kept in a position where it can be re-activated again with the least possible delay. Most of the production contracts awarded by the Department of Defense Production since 1951 include a clause which requires the contractor to maintain the tooling for 12 months, or to maintain indefinitely in good condition the equipment needed for defense production; in some cases the equipment will be removed from the contractor's plant and stored. Two large warehouses on Canadian Arsenals' property will be built to maintain a portion of such tooling.

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The R.C.A.F. contribution to the defense of the European theatre of N.A.T.O. consists of twelve *Sabre* squadrons making up four wings, plus an air materiel base at North Luffenham, England, and the necessary logistical supports units on the continent. For a long period these *Sabre* squadrons were the most modern units on the Allied side in Western Europe. The wing now

New equipment being delivered to the Royal Canadian Air Force includes Fairchild C-119 *Flying Boxcar* transports.

Canada supplied 375 Canadair-built *Sabre* fighters to the R.A.F. – ahead of schedule. Picture shows a batch on its way to England, lined up at Blule West One airfield, Greenland.

at North Luffenham will be transferred to Marville, France. The second wing is at Gros Tenquin, France; the third at Zweibruecken, Germany; and the fourth at Sollingen, Germany. An Air Division Headquarters has been set up at Metz under Air Vice Marshal Hugh Campbell. The R.C.A.F. Air Division is part of the 4th Allied Tactical Air Force, one of the two air forces under the command of A.A.F.C.E. (Allied Air Forces Central Europe).

For the air defense of North America, the R.C.A.F. and U.S.A.F. have set up a coordinated system. Under the radar set-up, the R.C.A.F.-manned units screen Canadian vital targets and the U.S.A.F. units American vital targets, even though the units themselves may be in Canada. This web of radar warning stations is connected by a network of communications. A ground Observer Corps has been organized which acts in conjunction with the radar units. The plan is to intercept any enemy bombers by means of R.C.A.F. all-weather Avro CF-100 *Canuck* squadrons and U.S.A.F. fighters.

Several of these CF-100 squadrons are operating, and the new Mark IV CF-100 is now coming off the assembly lines at Avro-Canada. Reserve squadrons operating *Vampires* and *Mustangs* will be re-equipped with CF-100's. With more emphasis now on the defense of Canada, additional radar stations are being built, landing strips established and communications extended.

Transport Command of the R.C.A.F. is receiving Fairchild C-119 *Flying Boxcars* and has taken delivery of two de Havilland *Comets* which are used to exercise the air defense system.

The R.C.A.F. is also taking delivery of Piasecki H21A helicopters for use in rescue operations, having already the Sikorsky S-51 in operation. Deliveries continue of the *Orenda*-powered *Sabres* from Canadair as well as de Havilland Canada *Otters* for Northern work. There have been few details released officially on the replacement for the R.C.A.F. anti-submarine reconnaissance *Lancasters*, although indications are that it will be a Canadair-modified *Britannia*. Eventually there will have to be replacements for both the *Sabre* and the CF-100, but these are developments which will take several years.

Altogether the R.C.A.F. operates more than 1,600 aircraft of 30-odd types. The estimated strength of the Service was more than 43,000 at the end of 1953, compared with a strength of 38,391 at the close of 1952.

The Royal Canadian Navy's air group, through the aircraft carrier H.M.C.S. *Magnificent*, plays an important role in another N.A.T.O. Command, SACLANT (Atlantic). The *Magnificent*, on loan from the Royal Navy, will be replaced in 1956 by Canada's new aircraft carrier, H.M.C.S. *Bonaventure*, now under construction at Belfast, Northern Ireland. The new carrier will carry squadrons of Grumman S2F anti-submarine chasers to be made at de Havilland-Canada and delivered early in 1956. Arrangements are also being made with the U.S. Navy to purchase McDonnell F2H-3 *Banshee* all-weather jet fighters for the navy's carrier-borne fighter squadrons. The Navy has recently taken delivery of a number of Sikorsky S-55 12-place helicopters.

Canada is devoting about $42,000,000 of its defense budget to aeronautical and other military research which is coordinated with that of other N.A.T.O. countries through AGARD (Paris). In Canada, research into Arctic problems, particularly those pertaining to flying, will continue to get primary attention. In cooperation with the R.C.A.F. the Defense Research Board has developed a special air navigation computer for the Arctic and has assisted in the preparation and publication of a manual of Arctic air navigation now adopted by the R.C.A.F. The use of jet propulsion has given great importance to such metals as *titanium*, and the D.R.B. is becoming interested in developing techniques for extracting these metals for N.A.T.O. use. The facilities of the National Aeronautical Establishment at Ottawa which will do much of this work will soon be completed.

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In 1953 Canadian aircraft carried three times the number of passengers they carried in 1946, more than 1,800,000 air travelers. It would seem that this growth trend will continue in 1954.

The significant increase in business has brought *a new concept of airline operations to the Canadian Government.* In 1937 Trans-Canada Airlines was established by the Government as the mainline operator on an east-west basis, while private operators—Canadian Pacific Airlines being the largest among them—were considered as feeder lines. Development has been so rapid that this concept is no longer adequate, and C.P.A.L. is becoming increasingly important as Canada's second trunk-line operator. However, T.C.A. will continue to fly unopposed across the continent for some time.

Canadian air transport growth in 1954 will be assisted by substantial additions to the fleets of both T.C.A. and C.P.A.L. These additions include T.C.A.'s eight Lockheed *Super Constellations* for use both on transcontinental and trans-Atlantic routes and the first of its 15 Vickers *Viscounts*. C.P.A.L. plan to order six *Comet IIIs*, have firm orders for three IIs plus a fourth under option, with delivery to start in 1954. These will be used on both C.P.A.L.'s new Vancouver–Mexico City–Lima service and the South Pacific route to Australia. Expected 1954 route expansion includes T.C.A. flights to Mexico City and Montego Bay, Jamaica. The tremendous industrial and mining projects in the Yukon, Northwest Territories, Kitimat, Peace River, Flin Flon and Labrador areas are now entering the development period. This should provide a more constant flow of air traffic with the emphasis on two-way transportation. With relatively low tourist fares to the Orient, the South Pacific and South America, C.P.A.L. expects that an increasing number of Canadian businessmen will be exploring these markets.

GREAT BRITAIN—Better than any

London, January 1954.—**The year will probably be recorded as the most important post-war year in British aviation. It will see the fruition of many production and development plans, and more particularly the introduction into service of the new generation of turbine-powered fighters, bombers and transports.**

A new budget policy will be formulated which, while only slightly increasing the overall amount spent by the United Kingdom, will use it in a different way. During the last three years vast sums have been spent on research and development. Now this initial phase is over, and the budget for the 1954-55 financial year—beginning on April 1st, 1954—will concern itself more with production.

Budget policy will hinge on the negotiations that have taken place between the United Kingdom and the U.S.A. on further defence aid. No official announcement has been made yet, but it is understood that Britain wants another $200,000,000 to be spread over a period of about two years—not to meet new commitments, but to see that the original re-equipment programmes are met.

This year will be the *first post-war year in which the Government will see practical results of the country's defence efforts.* In the 1953-54 Air Estimates the total appropriation for aircraft was £140,000,000. On the surface this is a large sum, but when it is considered that it is mainly made up of such types as de Havilland *Vampires* and *Venoms*, Gloster *Meteors* and English Electric *Canberras*, etc., and that these are not so costly as the latest machines, then the inevitable jump in production appropriations for the latest aircraft is obvious.

Research and development will continue unabated, but in years to come will concentrate on guided missiles and their associated electronics, new types of fighters and new electronics for Britain's "V" bombers *(Valiant, Vulcan, Victor)*.

This shift in research emphasis has been made possible by the ending of the development stage of such costly projects as the Bristol *Proteus* turboprop and Rolls-Royce *Avon* jet engines. The *Proteus* programme so far has cost over £9,000,000 and the *Avon* £22,000,000.

The overwhelming success of the *Avon* project is only just being appreciated. By channelling American aid, tools and money and a great deal of British capital via the M.o.S., the airframe manufacturers have been assured of a steady flow of engines to meet all demands. Originally it was thought that as in the U.S.A.

(Republic F-84F and North American F-86D, etc.), there would be airframes lying around awaiting power plants. The converse has been the case, and engines awaiting airframes are being stockpiled.

While the *Avon* production situation is one of the brightest spots in the British aviation picture, the *overall aspect of Britain's position in the jet engine field is less encouraging than it used to be.* This was forcefully brought home to the British public on January 6th by Sir Thomas Sopwith, the outspoken Chairman of the giant Hawker Siddeley Group. He bluntly told Hawker Siddeley shareholders that Britain's lead in jet engine development "has not only been cut down but in certain respects has been lost entirely"—a claim which American manufacturers have been putting forward for months. Sopwith added that the British "have jeopardized their position through timidity and are nurturing that timidity with complacency."

The airfield, depot and radar station programme has passed its peak in the United Kingdom, as in the rest of Europe, and savings are expected in this direction.

British Government policy since the end of the war with Germany has been to build up for a possible war in ten years i.e. 1954/55 and to look for danger about that time. If the war threat recedes then after 1954/55, a research and build-up programme for another distant date will be set.

This manner of proceeding has certain obvious drawbacks as well as advantages. The state of Britain's economy will not allow an all-out effort every year; it is therefore inevitable that periods will arise when sections of the R.A.F. and Fleet Air Arm are obsolete. Even now while the *Hunter* and *Swift* production lines are just beginning to flow, the budget planners for 1955/56 are retrenching and looking ahead to the next ten years.

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British aircraft industry has entered the year 1954 with considerable confidence. The sudden cuts in orders, with attendant dispersal of manpower, which took place when the Conservative Government came to power, are unlikely to recur, and production contracts for the year are large and firm. In addition, *for the first time the industry has a sound base of civil orders alongside its military work,* which offer the investor and the worker a confidence in aviation they have never had before. The Government makes no secret of the fact that it regards *aircraft exports as of prime importance* and will do everything in its power to see that the industry prospers.

The labour employed in the United Kingdom in the manufacture of aeroplanes, aero engines, propellers and undercarriages during the past few years shows a steady increase. Figures are as follows:— 1948: 141,500; 1949: 153,200; 1950: 153,600; 1951: 176,500; 1952: 203,800; and 1953: 224,900. These do not of course take into account the tremendous increases in employment in the accessories industry where firms have been continually expanding. Companies that previously did aircraft work as a side-line now find themselves relegating anything other than aviation to second place.

The big shadow across the board rooms of the industry is nationalization. This reared its ugly head during 1953 and is on the programme of the Labour Party if the latter is reelected. The heads of the aircraft industry naturally feel that nationalization would be a disaster of the first magnitude. More discussion of this subject will take place in the two camps during 1954, and there will be much plain speaking on both sides. It is most unlikely that it will be more than speaking, however.

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By the end of 1954, the Royal Air Force will be a revitalised service. It will have a number of operational squadrons of both *Swift* and *Hunter* fighters, and the first units will be re-equipped with *Valiant* bombers. Night fighting will have passed in the main from *Vampire NF.10s* and *Meteors 11s* to the *Venom FAW.3* with its powered controls and new radar. Pre-production *Javelins* will be available, but it is not expected that the production machines will start to reach squadrons until the following year. Pre-production batches of air-to-air, ground-air, and air-ground missiles will be delivered, but actual production will not come until 1955/56.

Several new military prototypes are scheduled to fly, including the Percival P.84 jet trainer, new marks of the *Canberra, Valiant, Hunter, Swift,* one or two research machines (rocket?) and probably a much rumoured all-weather fighter of very advanced design. On the transport side the prototype of the Vickers 1000, powered by four Rolls-Royce *Conway* engines for Transport Command may well be completed before the end of the year.

The Fleet Air Arm will also benefit from a steady flow of new equipment. The *Seahawk* will become the standard fighter/fighter-bomber with most squadrons, and the *Gannet* will take over from the *Firefly* in several units. The first production *Seamew* will be flying and the major naval prototype will be the twin jet swept-wing Vickers Supermarine 525 which is on Super Priority order.

The Hawker *Hunter* fighter is one of the new British aircraft to go into operational service during 1954.

The arguments for and against the light fighter will be brought into the open with the first flight of the Folland *Gnat* interceptor, when final Government decision on this type of machine will be made known.

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Civil aviation, like the services, will benefit from a "shot in the arm" in the shape of new equipment. Comet 2s will be in service and about the middle of the year will also start coming off the lines at Short Brothers. The production line of *Viscounts* by mid-1954 will be well on the way to the projected rate of 100 aircraft per year by mid-1955.

The major events will be the certification of the *Britannia*—expected before the end of 1954

English Electric *Canberra* light bomber production will probably be phased out this year. *Above, Canberras* made by Short Brothers at Belfast await flight testing.

—and the first flight of the *Comet 3*. By the time the *Britannia* is certified, several B.O.A.C. machines are likely to be flying, and the new line at Short's Belfast factory will be taking shape.

No prototypes in the DC-3 replacement class are expected to fly before 1955, but the lighter feederliner, the Scottish Aviation *Twin Pioneer* may be ready.

Helicopter development will continue, but the only outward and visible sign in the shape of a new flyable prototype will be the Fairey *Gyrodyne* with the rotor head and tip drive features of the Fairey *Rotodyne* Bealine Bus project. B.E.A.'s helicopter development unit will take delivery of one of the Bristol 173 helicopters.

There will be no major change where airfields are concerned, but efforts are being made to improve radio and radar aids at various smaller airports, particularly those opened up by new charter services. The various ICAO regulations regarding ground facilities will be more strictly adhered to and this will cover surveillance radar, cheap "one-man GCA" equipment, VHF radio and smaller items such as automatic tape recorders.

FRANCE — High hopes, but markets are needed . . .

Paris, January. **High hopes were aroused in the French aviation world last summer by the 20 th SALON DE L'AERONAUTIQUE—organized for the first time outside the Grand Palais—and the two-day Flying Display at Le Bourget Airport.**

The flights of the VAUTOUR, the TRIDENT, the MYSTERE, the BAROUDEUR, the MAGISTER, the FLEURET—to mention but a few—demonstrated that French aviation has spectacularly surmounted the tragic handicap placed in its path by the almost fatal lethargy into which it had sunk under the Nazi occupation.

But this enthusiasm was quickly chilled by the defence budget estimates. Reports were current that factories would have to be closed down, research and development stopped, production orders cut back. However, French aeronautics suffered less than anticipated, partly because of the financial aid accorded by the United States (for raising and equipping a native army in Indo-China, Fr. frs. 135,000,000,000; in direct contributions to the French budget, Fr. frs. 185,000,000,000), and partly because of the understanding attitude adopted by Defence Minister René Pleven. Better still, the Air Force appropriations—unlike the Army and Navy credits—showed an increase over 1953: Fr. frs. 270,300,000,000, against Fr. frs. 262,000,000,000*. From the personnel point of view the result will be an increase in strength by 15,000, including 1,500 officers and 9,000 N.C.O.'s. Procurement appropriations will be Fr. frs. 80,000,000,000 (including Fr. frs. 18,000,000,000 in off-shore and export orders), against Fr.frs.65,000,000,000 (including Fr. frs. 2,500,000,000 for off-shore contracts). Finally, research and development allocations will total Fr. frs. 26,500,000,000, compared with Fr. frs. 20,700,000,000 the year before.

The Minister of Defence personally explained the aim of his policy: *an air force of 1,000 first-line combat aircraft by the end of 1955.*

The money to be voted for 1954 is to make possible the establishment of 38 squadrons (there were 30 at the end of 1953), with a goal of 51 squadrons by the end of 1955. Personnel establishment, which was fixed at 117,000 for the end of 1953, is to increase to 133,000 by the end of this year. Equipment policy aims at the gradual replacement of obsolescent Allied aircraft with French-designed machines. The *Mystère II* and *Mystère IV* fighters now in production will be increased by 150 *Mystère IVB* day interceptors. An initial production batch of seventy SO 4050 *Vautour* attack aircraft will enable the first French light bomber units to be formed, and a new series of 40 Nord 2501 *Noratlas* cargo transports will go to the transport units. Finally, a contract calling for 100 Fouga CM 170 *Magister* twin-jet light aircraft will facilitate the training of jet pilots. Not to be overlooked is the pre-production series of the SE 5000 *Baroudeur* which, in the words of René Pleven, is "a fighter capable of operating from rudimentary fields, naturally camouflaged and sufficiently numerous to make each of them an unprofitable target for atomic attack."

Research and development will concentrate mainly on light-weight interceptors and their power plants, guided missiles, improved versions of existing jet engines *(Vulcain)*—and the construction of the Leduc 022 designed for a *climbing* speed of Mach 2!

Allocations for construction of ground facilities will be cut by Fr. frs. 5,500,000,000, from Fr. frs. 31,400,000,000 in 1953 to Fr. frs. 25,900,000,000 this year. The money will be spent on the completion of facilities authorized earlier and for the construction of three new bases.

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The new programmes and those in the process of execution are, however, insufficient to keep the entire French airfame industry in production. The industry's production potential exceeds military requirements—after the latter's adaptation to the nation's budgetary resources.

Air transportation can offer a certain market for the Nord 2501 and the Hurel-Dubois HD. 32, pending the availability of the HD 45 and the SE 210 *Caravelle;* sporting and private flying can absorb some Holste MH 1521, Sipa 200 und 300, NC 856 H aircraft as well as derivatives from the *Magister. But France's aircraft industry must receive fresh off-shore contracts and penetrate into the export markets.* The quality of its new products should make this possible.

Following is a brief sketch of the activities of French aviation manufacturers in 1954:

S.N.C.A. du Sud-Est: SE 5000 *Baroudeur (Atar)*, pre-production series; *Caravelle* jet transport, prototype; *Durandel* delta-wing light weight interceptor, prototype; guided missiles; Republic F-84F and RF-84 spares and overhaul; *Sea Venom*, phasing out; *Alouette* turbine-powered helicopter, new prototype; *Mystère IV* and Fouga 17OR *Magister* sub-contracts; SE 2010 *Armagnac* overhaul.

S. N. C. A. du Sud-Ouest: SO 4050 *Vautour*, small production series as the forerunner of larger orders: three versions, two-seater all-weather fighter, single-seater fighter-bomber, two-seater attack bomber; *Mystère* sub-contracts; SO 9000 *Trident*, two military prototypes, with rockets; *Djinn* compressed-air helicopter, pre-production series, to be followed by production in 1955; development of *Farfadet* compound helicopter, new versions of *Vautour* and *Trident*—the latter possibly as a missile; the *Dogue* night intruder . . . still shrouded in secrecy.

S.N.C.A. du Nord: Nord 2501 *Noratlas* twin-engined transport, production, contract increased by 40; NC 856 artillery observation post, phasing out of production order for 112 aircraft; *Sea Venom* wings; NC 701 and NC 702 *Martinet* and *Goëland* overhaul; Nord 3200 trainer, prototype (spring 1954); *Harpon* canard-type interceptor, flying scale-model; *Noratlas* turboprop version; *Matra-Cantinieau* turbine helicopter prototype; a two-three-jet liaison aircraft prototype—on the secret list.

Marcel Dassault: MD. 450 *Ouragan* phase-out; *Mystère II (Atar)* and *Mystère IV* (H. S. *Verdon)*, production of 150 and 225 machines, respectively; provided for under budget: 150 *Mystère IVB's* (reheat *Avon RA. 7* or *Atar);* development of *Mystère IVN* two-seater all-weather night fighter and *Mystère XX (Avon* RA. 14) sharply-swept thin-winged fighter; moreover, development of the hush-hush MD 550 delta-wing light-weight interceptor. Finally, A. S. *Viper* light jet engine, pre-production series under licence, development of a more powerful version.

Etablissements Fouga: Two pre-production series of five CM 170 *Magister* twin-jet trainers each, one with Hispano-Suiza, the other (like production version) with Messier undercarriages. Preparation of full production, in collaboration with Morane, of the 100 *Magisters* on order; development of *Magister* derivatives.

Morane-Saulnier: MS 733 trainer production phase-out, Fouga *Magister* sub-contracts. Engineering work on a (private venture?) interceptor prototype.

Hurel-Dubois: The HD 31 high-aspect-ratio-wing aircraft will probably be certificated for a useful load of 8,800 lbs. (4,000 kg.), or even more than 10,000 lbs. (4,600 kg.), compared with an initial load of less than 5,000 lbs. (2,200 kg.). This would augur well for the HD 32, on order for Air France

* At this writing the defence estimates have not yet been voted, but it is certain that the final figures will hardly differ from those quoted.

(24) and the *Institut Géographique* (4). Total orders for this "DC-3 replacement" are expected to reach 150. Work continues on the HD 45 twin-jet prototype.

Louis Bréguet: Three Bréguet *Deux-Ponts* to be delivered to Silver City Airways, car ferry operators, the last four *Deux-Ponts* will go to Air France. Overhaul of this type of aircraft, modifications to increase all-up weight to 113,500 lbs. (51,600 kg); subcontracts for *Noratlas*, production of Bréguet 901, Air 100 and Jarlaud sailplanes; various research contracts.

SIPA: SIPA 921 fighter trainer, new production batch of 50; SIPA 200 light jet two-seater, pre-production batch of five and possibly establishment of production line. Projects for a three-jet (Palas) four-seater liaison aircraft and a twin-engined utility transport.

Max Holste: MH 1521 utility transport, first production series for Air Force, to be followed by larger contracts.

SFECMAS (ex-Arsenal): Guided missiles derived from SS 10, Type 5501 target drones, tests of SFECMAS 1401 delta-wing *(Atar)*. Work on ramjets and high precision flight measuring systems.

Matra, ECA and **SFENA:** guided missiles, very hush-hush.

Potez: Development work on Potez 75 armoured close-support aircraft; production of Potez piston engines (160 to 700 h.p.).

SNECMA: Production of *Atar* 101D, 101E, 101F jets, pre-production series of *Vulcain* of present 11,000-lb. thrust version, trials on an *Armagnac* flying test-bed; work on a light jet, on pulse-jets, on jet-reversal systems. Continuation of current piston-engine production.

Hispano-Suiza: Development and production of R. R. *Tay* and H. S. *Verdon*, the latter an improvement of the *Tay;* establishment of *Avon* production line; production of *Nene* and Pratt & Whitney spare parts; as well as undercarriages.

Salmson: Production of 9 NH 02 engine.

Turboméca: Production and development of a wide range of light gas turbine engines.

Messier: Landing gears for *Mystère*, *Magister*, *Noratlas*, SIPA, Fiat 80, etc. British Messier makes *Britannia* undercarriages. Production of *Ministop* anti-skid device at a rate of 300 a month.

*

French air transportation will be in a less favoured position during 1954 than the Air Force.

Paul Devinat, Under-Secretary of Public works and Civil Aviation—a new post which, it is fervently hoped in France, will become permanent— did not get the appropriations he had requested. His department will receive only Fr. frs. 15,000,000,000 for operating expenses and Fr. frs. 17,000,000,000 for capital investments. As a result, improvement of ground facilities will slow down, and work on one of the two medium-haul twin-jet transport prototypes on order (HD 45 and SE 210 CARAVELLE) may even be suspended.

Furthermore, it will be necessary to shelve the first instalment of the five-year plan involving the expenditure of Fr. frs. 30,000,000,000 for new flying equipment (capable of 500,000,000 tonne-kilometres a year) and of Fr. frs. 100,000,000,000 for ground facilities.

Among the airlines, the year 1953 witnessed a number of consolidations of private carriers. *Compagnie Générale de Transport Aérien Air-Algérie* resulted from the "marriage" of *Air-Algérie* and *Air Transport; Compagnie Chérifienne de Transport Aérien* emerged from the amalgamation of *Air-Atlas* and *Air-Maroc*.

Only five major airlines remain of the fifty-odd companies which entered the field of air transportation in France at the close of World War II. Nearly all of them are solidly backed by shipping interests *(Chargeurs Réunis, Cie Générale Transatlantique, Messageries Maritimes, Compagnie Paquet*, etc.). And competition is fierce between the four private lines—U.A.T., T.A.I., Aigle-Azur, C.G.T.A.A.A.—and Air France, the national carrier.

U.A.T. will add three Douglas DC-6As (bought from Slick Airways) to its three *Comet 1s*, its *D.H. Herons* and Douglas DC-4s.

T.A.I. will receive two more Douglas DC-6Bs, making five of the type, in addition to its fleet of DC-4s.

Aigle-Azur will augment its Boeing 307 *Stratoliners* and DC-3s with two Douglas DC-6Bs.

C.G.T.A.A.A., will also take delivery of two DC-6Bs.

Thus, the "big four" private carriers seem to be determined to defend their positions against Air France. *Will they be able to hold out in the long run without grouping together*, at least through technical agreements? The problem will certainly be spotlighted sharply and—perhaps—resolved this year.

A point worthy of note is that Air France, unlike some other European operators, has reaped substantial benefits from the introduction of tourist-class services. Even better results are expected as these I.A.T.A.-sponsored schedules are extended to new destinations.

The SO 4050 *Vautour* is one of the ultra-modern French aircraft that will go into production this year. Above, the single-seater fighter-bomber version.

A national air transport charter—which has been in the mill for years—plus a coordinated system of schedules and rates and even equipment seems indispensable if detrimental competition is to be avoided. This is a task tailored to measure for the Department of Civil Aviation . . .

Despite strikes and fog the private airlines and Air France made much progress in 1953. There is no reason why such progress should not continue this year, especially since all the lines will be operating more modern equipment.

Air France, has received or will get twelve Bréguet *Deux-Ponts*, ten Lockheed *Super Constellations*, twelve Vickers *Viscounts* and three *Comet Is*. On order are six *Comet IIs* and twenty-four Hurel-Dubois HD 32s.

Finally, 1954 will see the inauguration of an important new line which, however, is hardly a commercial operation in the accepted sense: The *Toulouse*—Beirut—Karachi-*Saigon*-Airlift. It will be operated with seven SE 2010 *Armagnacs* by S.A.G.E.T.A., a company owned jointly by Air France, T.A.I., Aigle-Azur and S.N.C.A. du Sud-Est.

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Next month Interavia will publish the aviation prospects for Italy, which will have finalized plans at the end of January — too late for this issue; Germany, whose fate is now being debated by the Big Four in Berlin; the Scandinavian countries, which are discussing their budgets at the time of writing; and other countries.

"I'm not Afraid to Fly"

I forget whether the Paris I.A.T.A. conference I am speaking of took place in 1929 or 1930. All I remember is that the four of us had met by chance at the Gare du Nord: Major Wronsky of the *Deutsche Lufthansa*, who took his own life in 1947, Albert Plesman of K.L.M. —Royal Dutch Airlines, whose fate overtook him on December 31st, 1953, Sabena manager Renard, who was fatally injured in a railway accident in Hungary in the early thirties. Of the four, I am the only survivor. And as we were waiting for the Nord Express, Plesman remarked ironically: "How can we expect our air transport business to prosper if we ourselves all travel by train?" Wronsky screwed his monocle more firmly into his eye and answered: "The layman flies . . . the expert goes by train . . ."

Admittedly, air transport at the end of the twenties could not be compared with what it is today, although even in those days there were winter services of a kind. Radio for aircraft was just being talked about, but no more; radar was still unknown; yet flying went on. Passengers in those days were certainly not greater heroes than they are today, but the far fewer crews formed such an elite body that they inspired almost unlimited confidence. And subsequent development has shown that the air transport bosses of the day knew their business. They did what they could for their passengers, though they could offer them neither pressure cabins nor "dinners by Maxims."

Yet it is with definite pleasure that I recall the flights which were operated between Paris and London by Air Union, the French firm that had been founded by Louis Bréguet and was run by Albert Gauchet from a basement office. This firm had a kind of luxury service, with the inviting name "The Golden Ray," flown by a converted World War I Lioré & Olivier biplane bomber with two water-cooled Renault engines. Pilot and mechanic sat up in front in the open, and inside on ten light wicker chairs sat the passengers, who in winter were given a rug each as the height of comfort. The only person on board who sometimes looked uncomfortable was the newly invented steward who froze to death in his white linen jacket and cheered his passengers up with a cognac when it got too cold or stormy. When the aircraft reached the French coast it made a circuit to show that the great adventure was about to begin. The French station then telephoned to the English side. After the Channel crossing another circuit was flown, as a signal that news of the aircraft's approach might be telephoned to London. Air Union's London representative could then drink his whiskey in peace.

"The layman flies, the expert goes by train . . ." Martin Wronsky of the Deutsche Lufthansa in 1930, when four delegates to a I.A.T.A. conference met at the Gare du Nord in Paris.

That is what winter air travel used to be like. Today's airline chiefs would be deluding themselves if they imagined they had invented anything new. Even then there was air freight and air mail. Mr. Bamford, Air Union's London freight agent in those days, is now Air France representative in Great Britain and can confirm the truth of this. I would even go further and say that the air freight service does not work any better today than it did then. But more of that later.

*

These subjects became topical again at the end of 1953, for two reasons.

For one thing, the world-renowned violinist Yehudi Menuhin, who now lives in California, created quite a storm in the British press when he explained, in an open letter to the "Times" and the "Daily Mail" on December 30th, the reasons for his decision not to travel by air for the time being. "I'm not afraid to fly," he said. But night crashes into mountains and other accidents had taken the lives of so many artists, musicians, scientists and other intellectuals

After World War I the French firm of Air Union used converted Lioré & Olivier bombers for its "Golden Ray" luxury service between Paris and London.

Passenger cabin with wicker chairs in a converted Farman *Goliath* bomber used for commercial air services after World War I.

The well-known violinist Yehudi Menuhin explained in letters to the "Times" and the "Daily Mail" at the end of 1953 why he had decided not to travel by air for the time being.

Dr. Walter Berchtold, President of Swissair, complained to the Swiss National Air Transport Conference in December 1953 of the low passenger volume during the winter season.

during the past few years that he no longer felt comfortable about flying; he had no longing for a hero's death. Yet he could say that he had never shrunk from flying in bombers and under all conditions of war and peace, in all kinds of weather. But he regarded it as a deficiency that there was not a greater demand for the introduction of aircraft radar equipment to prevent accidents. Measures could be taken and equipment fitted to reduce the danger of accidents, he maintains, and thus to increase public confidence.

Menuhin's remarks produced reactions from Britains' Decca Navigator Co. Ltd.—who have incontestably done a great deal towards preventing accidents—and some rather weak rejoinders from spokesmen of Eastern Air Lines, Pan American Airways and United Air Lines: general introduction of airborne radar in commercial air operations could not be expected in 1954, but this would doubtless be possible in a few years' time . . . Statements of this kind obviously are not good enough for Mr. Menuhin, nor do they prove him wrong, and the affectionate wives of businessmen travelling by air today will scarcely be consoled by promises for a few years' time.

*

The subject of air-mindedness came up again at the end of 1953 in a speech by the President of the highly esteemed airline belonging to one of the smaller countries, before the Swiss National Air Transport Conference on December 7th. In his well-documented lecture, Dr. Walter Berchtold of Swissair discussed a number of problems which confront his company—and doubtless others as well—today. Real money, he said, could only be earned on the long-haul services, and Swissair was therefore obliged to try and expand in this field. The air freight side of the business should also be extended and airmail volume increased. Above all, however, Dr. Berchtold complained bitterly that traffic volume was so low in winter. It was essential that this lack of air-mindedness among the public should be overcome. Air travel in winter was just as profitable and safe as at any other time of the year. Something must be done at once.

Berchtold's cry did not remain unheard. Three days later, on December 10th, 1953, the best-known newspaper in Switzerland, "Neue Zürcher Zeitung," produced a special supplement entitled "Fly in Winter," or "Encouraging Winter Traffic by Rate Reductions".

With all due respect to Dr. Berchtold and to the latter excellent supplement, I found certain of their arguments unpalatable. The N.Z.Z. writes:

"Today we have got to the point where we can entrust ourselves to the aircraft at all times of the year, in the certain knowledge of being protected from harm by every possible safety precaution. It may be that the early days of flying, when regular air services were simply closed down at the end of October, are still in people's minds. This would explain their prejudice against flying in winter—for it is a prejudice. Today fog is the only weather condition which prevents flying schedules from being kept or necessitates diversion to airports other than one's destination. This regrettable fact sometimes causes the businessman with important engagements to go by train over short distances in winter, rather than by air . . ." The writer adds that Dr. Berchtold's remarks—that summer frequencies were double those in the slack winter months—were "by no means motivated by Swissair's commercial interests alone; general economic problems were involved here, and the whole future of Swissair transportation . . ." He concludes . . ." One thing is certain. Air safety in winter is no lower than in summer . . . On the contrary, engine performance improves in winter, thus giving shorter take-off runs and reducing the risk of engine failure. Effective measures are already in use against icing, and electronic aids in the shape of radar equipment will do the rest . . ."

*

This would be all very fine if every airport had adequate radar equipment—a surveillance radar and a precision approach radar—and if all aircraft carried radar instruments on board. But to say that air services—or for that matter any form of transport—function just as well, if not better, in winter as in summer is pure exaggeration. Unless I am much mistaken, even the railways encounter difficulties during the winter season, shipping fears the winter, and motoring is not an undiluted pleasure—despite snow tyres, chains, fog lamps and heating. Nobody will deny all this.

These two familiar figures—on the one hand the musician and experienced air traveller Yehudi Menuhin, and on the other Swissair President Dr. Walter Berchtold, member of the International Air Transport Association's Executive Committee—taken at random, seem to represent diametrically opposed views. Yet it seems to me that both tend to talk round the subject. The point in question is not the undoubted high degree of safety in air transport; to my mind the central problem is the air service's *regularity during the bad season of the year.*

Dr. Berchtold wants a winter traffic volume comparable to that in summer, more air crago, and more air mail; the following examples may help to show where the snags still lie.

Daily Mai

YEHUDI MENUHIN replies to COURTENAY EDWARDS

I'M NOT AFRAID TO FLY

Neue Zürcher Z

und schweizerisches Handelsblatt

Fliegt im Winter!

"I'm not afraid to fly" said Yehudi Menuhin in his open letters . . . "Fly in winter" says the "Neue Zürcher Zeitung".

First an answer to the question of why passenger volume is not yet as great *in winter.*

Shortly before Christmas a Swiss businessman booked a seat on a T.W.A. *Super Constellation* flight from New York via Paris to Geneva, planning to fly on from Geneva to Zurich by Swissair. The Atlantic was crossed in every comfort in a flying time of fourteen hours, and the landing at Orly Airport, Paris, was as smooth as silk. But weather conditions in Switzerland were bad—QBI. The weather was expected to clear in Geneva by about mid-day, and T.W.A. officials stated that the machine would fly on to Geneva a little behind schedule. However, the weather forecast proved to have been a trifle optimistic, the T.W.A. aircraft waited a bit longer in Paris, then left the Geneva passengers to their fate and flew over their destination on to Rome. Because of T.W.A.'s hesitations in Paris, these passengers missed the morning train to Switzerland, had to hang

around in Paris until the evening and finally arrived in Switzerland nearly twenty-four hours late. The main stage of the journey, across the Atlantic, had been completed without hitch, in fourteen hours, but it had taken twenty-four hours to get from Paris to Zurich. Such is short and medium-stage air travel in winter; something should obviously be done.

Then there is the question of *air freight*. Here are two examples to show that all is not as it should be here either.

On July 10th, 1953—in full summer—an air freight consignment was sent off from Los Angeles to Geneva. It was first carried by United Air Lines to New York, where for some unexplainable reason it did not arrive until July 15th. On the 16th U.A.L.'s freight office decided to send it on by Pan American Airways (P.A.A. flight 100) to London, where it arrived on the 17th. The same day P.A.A.'s freight section in London handed the packet over to British European Airways for carriage to Geneva. Again for some indefinable reason, it lay around in London until the 19th, and finally reached its destination on July 21st.

Obviously this was quicker than in the days of Christopher Columbus, but it cannot really be called air freight! There is something wrong in the cooperation between the various airlines and the freight agencies.

Another example: On Septembre 30th, 1953, an air freight consignment was handed to Swissair in Geneva for Montreal. It reached the consignee on Octobre 15th. What happened here is even less clear. The Customs in Montreal received the packet on October 9th—ten days later. They released it on the 13th, and then it took two more days to get from Montreal airport into town.

It would seem that the ways of world air freight service, like God's, are past finding out. Otherwise it is difficult to explain why freight from Los Angeles for Geneva should be sent via London and why a parcel from Geneva should take 15 days to reach Montreal. Air freight should take a lesson from the taxi driver of any city, who is in duty bound to take the shortest route, so as to avoid waste of time and money.

In much the same vein, an interesting article in the "Saturday Evening Post" of 26th December, 1953, entitled "Those Lost-Luggage Mysteries," described how, when General MacArthur arrived at La Guardia, his luggage and that of his wife and son had disappeared completely and was not found for some long time. The General was somewhat perturbed, as the luggage contained his many medals and uniforms. The American conductor Eugene Ormandy and his wife flew to Brazil . . . but their baggage landed in Bermuda. Admittedly the airline's task is not always an easy one. A cat that was carried from Idlewild Airport, New York, to Philadelphia gave rise to the following telegram: " . . . Between IDL and PHL cat broke out of carton. Same cat had done same thing at IDL, was not ordinary cat. Resembled tiger. Cat lassoed in PHL. Left there . . ."—Not bad.

It would be too easy to dispose of such problems as fear of flying, irregularity of winter air services or the vagaries of air freight with purely negative criticism. Criticism should be constructive, and the following constructive suggestions may perhaps be permitted.

Before the war there was a well-known Swiss pilot named Walter Ackermann who lost his life in a Diesel-engined Junkers Ju 86 in 1939. His books on flying are still counted amongst the best examples of aviation literature. If he had lived he would probably today have been on the management of Swissair or on the Swiss Air Staff—or even one of the editors of the "Neue Zürcher Zeitung." Ackermann one day wrote the following sentence: "People come to you with figures of 100 % safety and regularity, they entwine the air passenger with promises which cannot be kept, and the passenger believes them. But one day when he opens his newspaper he sees there has been a serious accident, and the statisticians expect him to swallow it without a murmur."

The same kind of figures are often used today. According to Yehudi Menuhin in the "Daily Mail", statistics prove that he could reach the age of 78 without being killed in an air crash. But this prospect did not altogether delight him, as statistics could be made to prove anything. Is he altogether wrong?

*

If passenger volume is to be increased in the winter, radar equipment both on the ground and in the aircraft must be substantially increased and improved. The result would be a definite improvement in regularity, and the air traveller could count with reasonable certainty on arriving at his destination and not being left somewhere en route, as in the case of the man who wanted to fly from New York to Switzerland. Yehudi Menuhin would have no more forebodings, since he would know that his aircraft would be guided down by precision radar at every airport, that radar on board the aircraft would detect any obstruction early enough to enable it to be avoided.

For a long time the subject of safety in air transport was sedulously avoided, so as not to scare the public. However, the Menuhin case and the drop in passenger volume during the winter show clearly that the public has thought about the matter for itself.

Why don't the big I.A.T.A. companies get together and award a substantial annual prize for improvement to regularity and safety in air transport, a kind of Nobel Prize for commercial aviation? Quite apart from the publicity value of such a gesture, it would surely not be long before electronics engineers, research centres and electrical equipment manufacturers would produce ample equipment to remove all fears. And it should be regarded as an obvious duty by the airlines, I.A.T.A. and I.C.A.O. and by the Governments concerned, to put available and future equipment into use as quickly as possible.

As regards air freight, it is useless to advertise in the daily press—with slogans about the "most experienced airline in the world" and the like, if every company does not have an adequate number of trained staff. Freight should be handled by experts at all freight offices and airports, and experienced salesmen should canvass industries and commercial houses to encourage a greater and greater flow of air freight.

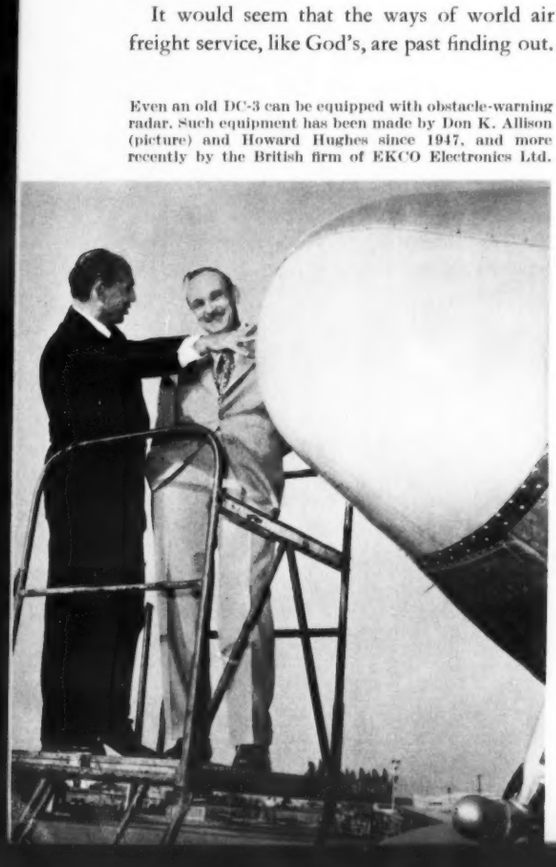
The airlines would like to increase their air mail volume. At one time special stamps were issued to encourage air mail. What is being done today in this direction? There are innumerable cable companies—such as Western Union, Radio Switzerland, Italcable and all the rest—who regularly supply their customers with pads of cable blanks, as a means of advertising. But I have never heard of an airline sending its big air mail clients a packet of air mail envelopes, with a special watermark for example, to show that it is interested in its customers.

"The expert goes by train, the layman flies." —"I'm not afraid to fly . . ."—"Flying is safer in winter than in summer . . ." These are all catchwords which get us nowhere.

Only positive facts will tell, such as a prize for regularity and safety, or direct contact with the customers from which air transport hopes to live!

EEH

Even an old DC-3 can be equipped with obstacle-warning radar. Such equipment has been made by Don K. Allison (picture) and Howard Hughes since 1947, and more recently by the British firm of EKCO Electronics Ltd.



Convair "TRADEWIND"

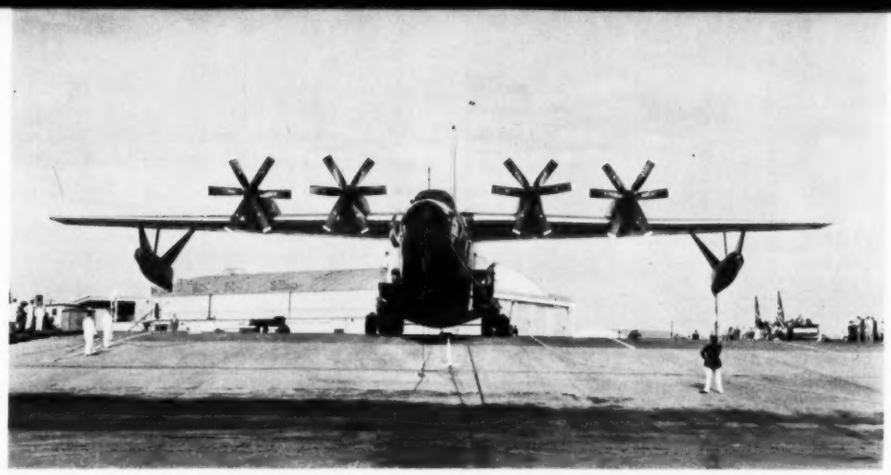
For many years it has been the accepted view of aviation experts that the flying boat is doomed to extinction. And for as many years new water-based aircraft have made their appearance on the aeronautical scene. It is curious to note that they have nearly always been the products of the same flying-boat-enthusiastic manufacturers — Consolidated-Vultee and Glenn L. Martin in the U.S.A., Short Brothers and Saunders-Roe in Britain.

Consolidated-Vultee on December 17th launched their latest contribution to the flying-boat family—the first production model of the Convair R3Y-1 *Tradewind* four-engined marine transport. The aircraft is derived from the Convair XP5Y-1 patrol-bomber prototype and is powered by Allison T-40 propeller-turbines of more than 5,500 e. s. h. p. each. Gross weight is approximately 80 tons, span 145 feet, length 142 feet 6 inches, height 51 feet 5 inches, maximum speed more than 350 m. p. h. The type is pressurized and air conditioned and has rearward-facing passenger seats. It can carry both seated and litter patients in addition to troops and cargo.

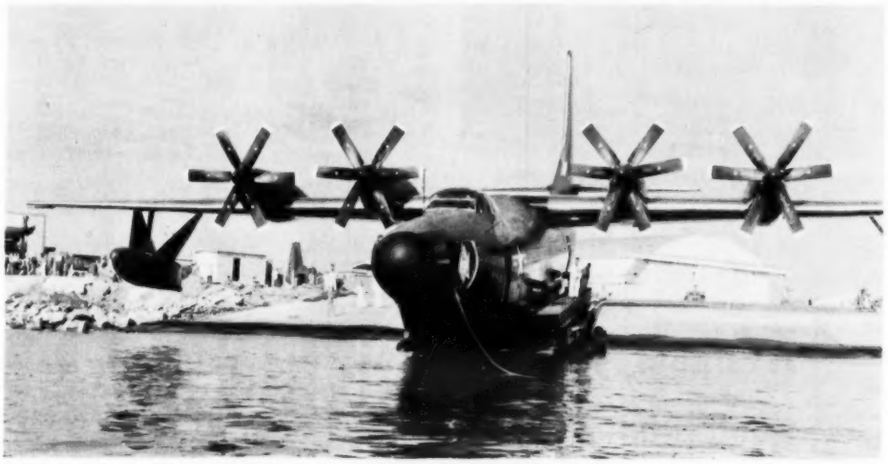
The U. S. Navy has ordered a small fleet of these aircraft for trans-Pacific service, and several will be delivered during 1954. They will be operated by the Navy's Fleet Logistics Air Wings and will be based at Alameda, California.

The ceremony of launching the R3Y-1 *Tradewind* was performed in the American tradition by Esther Williams, Metro-Goldwyn-Mayer aquatic film star. Distinguished guests included Vice-Admiral Harold G. Martin, Commander of the U. S. Pacific Fleet Air Force, and that old timer of the aircraft manufacturing industry, Reuben H. Fleet, founder of Consolidated Aircraft Corp. (now Consolidated-Vultee).

Miss Williams broke a champagne bottle—filled with water from the Seven Seas—on the bow of the boat, which then was trundled into San Diego Harbour.



The R3Y-1 *Tradewind* transport flying-boat on its launching cradle, ready to take to the water.



Down she goes . . . *The Tradewind* enters one of her natural elements.

Still on her cradle, the *Tradewind* starts up her propeller-turbines.

The *Tradewind* rides at anchor. Foreground: a wartime Convair *Catalina* patrol-bomber flying-boat.

Donald W. Douglas, President of Douglas Aircraft Co.

A Conservative Revolutionary

THE GROWTH OF DOUGLAS AIRCRAFT

Reason before risk

"Have the United States been caught napping in the development of jet airliners?" . . . "Will American piston and compound-engined types be able to compete with foreign jet transports?" . . . "How far advanced is Douglas's jetliner project?" . . .

Such are the questions hurled day after day in the press at Douglas Aircraft Co.'s President. Although we appreciate (and share) the public's hunger for news, we can also understand that this never-ending question-and-answer game might begin to get on Donald W. Douglas's nerves.

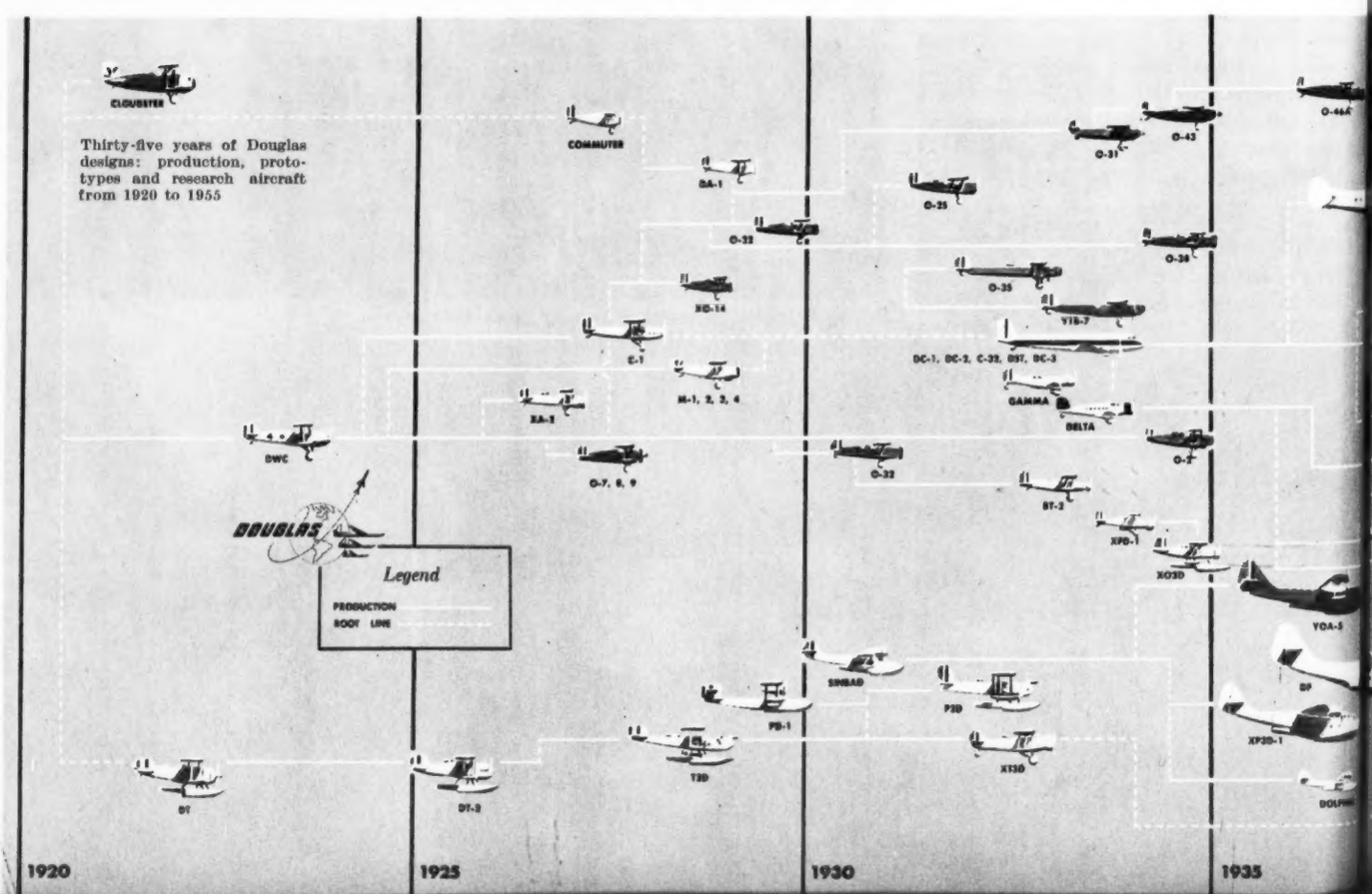
So, on October 9th, 1953, Douglas gave his answer. Speaking to the Chamber of Commerce at Fresno, California, he said:—

The new Douglas DC-7 would provide service on a par with the more expensive "and more or less experimental, untested performance of jets-to-be, promised elsewhere for the next few years" . . . In the aircraft business the race is not always won by "the swiftest or the first to start" . . . "Airplanes should make money as well as headlines."

Although Douglas was continuing its studies and design work on jet-propelled passenger airliners, the company did not plan to begin construction of such a type until it had satisfactory answers to such problems as initial purchase and maintenance cost, size of the market, noise control, economical fuel consumption, adequate range for trans-oceanic operations, suitable landing fields and safe traffic patterns in metropolitan areas. "When the time comes to build jet transports in America, they will be built."

These statements were not designed to "appease" an impatient public, nor were they a veiled admission that "the grapes were out of Douglas's reach." His words should be taken at their face value. They represent the creed of a man who has built and sold tens of thousands of aircraft during the past three decades, who has never been afraid of revolutionary innovations, but has always considered it his duty to put reason before risk.

It may be that Donald W. Douglas's hobby —he is an ardent fisherman—has helped develop this trait of character in him. There is certainly no denying that patience and caution (not to be confused with an inactive "wait-and-see" attitude) are among the assets of Douglas Aircraft Co.; and results justify the method used. In its history of over thirty years Douglas has only twice had to report a financial loss: once during the 1946-48 retrenchment years, when the American aircraft industry—or to be exact the whole of American aviation—was faced by economic ruin. The gravity of this crisis can be judged from New York Stock Market estimates that Douglas, Lockheed, Consolidated Vultee and Boeing put more than $200,000,000 into the development of their transport types during the critical years. Douglas came out of 1946-48



without excessive difficulty, thanks to a far-sighted financial policy.

His first debit balance, shortly after the foundation of his firm was a great deal more serious. The company was still very weak, to put it mildly; the situation was almost hopeless. In defiance of the advice of experienced economists and designers, Douglas had left his safe job as Chief Designer to Glenn L. Martin to form an aircraft factory of his own on the coast of California. He was firmly convinced that Californias's climate, the rising industry in the region, the business world's growing interest in the Pacific region would make Los Angeles an ideal centre for the infant civil aviation. His forecast proved correct—but not until ten or twenty years later. Meanwhile his firm, founded with the slender capital of six hundred dollars in a small shed behind a barber's shop in Los Angeles, almost perished, waiting for the orders that were long in coming.

No big potatoes . . .

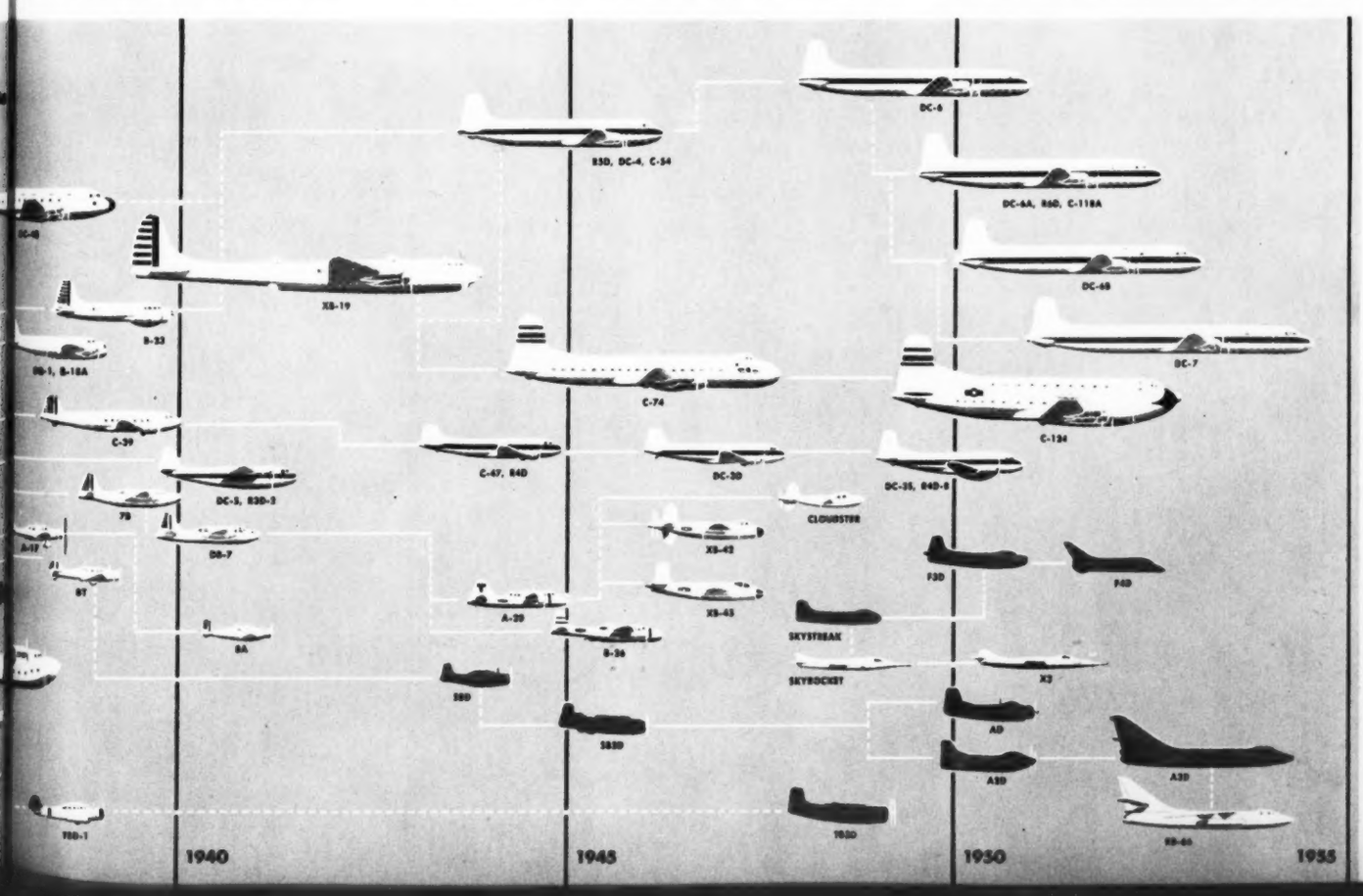
Donald Wills Douglas—today head of a business with 65,000 employees, annual sales of over $ 500,000,000, a backlog of unfilled orders of over $2,000,000,000 and current assets valued at around $55,000,000—did not have a "big business" background. When he was born in Brooklyn on August 6th, 1892 his father, William Douglas, was a senior bank clerk, who gave his son a solid education but had no great fortune to bestow on him. After attending the famous Massachusetts Institute of Technology, Donald Douglas became Chief Designer to Glenn L. Martin, Cleveland in 1916 and in 1918 designed the well-known twin-engined Martin bomber which, years in advance of all competing designs, was to become the standard equipment of both the United States Air Corps and certain European air forces. This is the position he gave up two years later to take half a dozen colleagues off to the West Coast. For the fisherman the move was a full success: Californian waters are teeming with swordfish and other game. For the aircraft manufacturer, however, the outlook was bleak at first. For months there was not the slightest trace of a customer behind the barber's shop on Los Angeles' Pico Boulevard. Understandably the $600·00 capital dwindled rapidly. To pay his rent and buy tools, Douglas went into agriculture. He rented a field and grew potatoes . . . or tried to at least. Millions of people have since flown in Douglas aircraft, but nobody ever ate a Douglas potato. The field was a swamp.

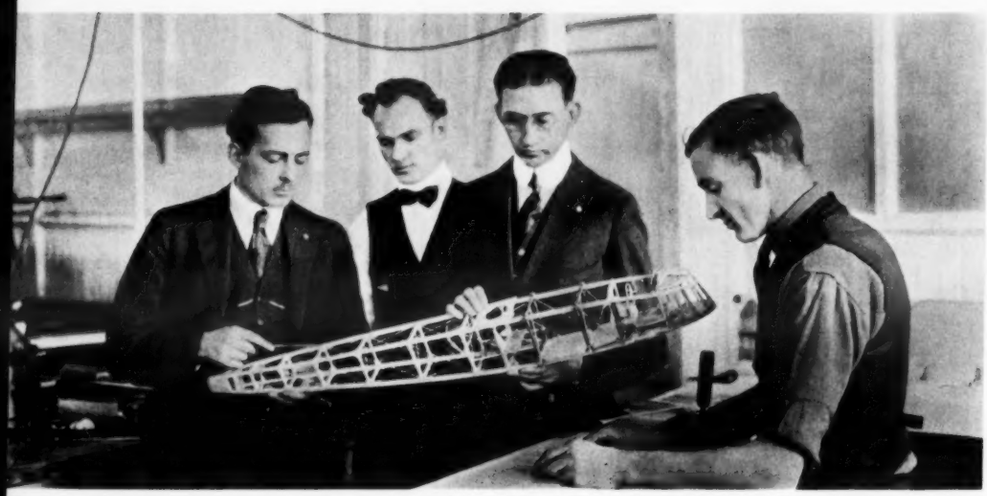
At last, when morale had dropped to freezing point, the first customer appeared. David R. Davis, a wealthy young sportsman, had made up his mind to be the first to fly coast-to-coast across the American continent. He not only ordered a biplane from Douglas but even became a partner in the young business, now named Davis-Douglas Company. From an engineering point of view the two-seater *Cloudster* built for Davis was a masterpiece; it was the first aircraft in aviation history which carried as much useful load as it weighed itself. From the publicity point of view, however, it was a failure. Engine trouble forced Davis to come down at El Paso. And as the *Cloudster* was returning to Los Angeles by train, the New York–San Diego route was being flown by a Fokker T-2.

However, the *Cloudster's* reputation had got through to the United States Navy, who gave Davis-Douglas Co. an order for three torpedo aircraft of the *Cloudster* type. By this time, however, Davis had lost interest in the firm: he had put roughly $40,000 into his trans-Continental aircraft and now he sold his share of the business to Douglas in return for a promissory note for $2,500. A little later Bill Henry, the third partner—Martin's former press chief, who had gone to Los Angeles with Douglas—also withdrew from the company; a second promissory note, for $5,000, bore the signature Donald W. Douglas.

"Constant development is the secret": the Douglas DC-3 (here the modernized Super DC-3) with its successors, DC-4, DC-6, DC-7.

If Douglas had been less determined, this would have been the end of his venture. But he was not the man to give up. Somehow he got hold of enough capital to carry on. He reduced his own salary to $200 a month. At thirty he showed himself as resourceful as when, as the





1918: Chief Designer Donald W. Douglas (left) showing his boss, Glenn L. Martin (second from right) the fuselage model of the Martin twin-engined bomber of his design.

thirteen-year-old editor of his school magazine, the "Handy Magazine," he had to apologise for the absence of lower-case t's from his typesetter's box. He did it by saying that this was "noT enTirely The faulT of The prinTers."

The fabulous DC-3

Douglas built the three *Cloudster* torpedo-bombers for the U.S. Navy. The Army then asked for a relatively large number of observation aircraft—his first order topping the million dollar mark. Then followed the M-1 to M-4 mail aircraft, earliest forerunners of the famous family of Douglas airliners. And with the first round-the-world flight by three American officers in Douglas *World Cruiser* seaplanes in 1924, the name of the California designer began to acquire international fame.

Though the *World Cruiser* was to be the forerunner of a large family of flying boats, the last offspring of which appeared in the mid-thirties, Douglas showed remarkable foresight by banking on the *landplane* for future long-range transportation. When P.A.A. in 1937-38 wrote the specifications for a trans-Atlantic airliner, the "Yankee Clipper," Douglas's project was the only landplane design of the five submitted to Colonel Lindbergh's selection committee (the others were by Boeing, Consolidated, Sikorsky and Seversky). Though this time his design was turned down (as is known, P.A.A. chose the Sikorsky S-42 flying boat), the subsequent victory of the landplane over the flying-boat was to prove him right all along the line.

*

Throughout the years Douglas has repeatedly shown acute perception. As early as 1935, for example, when Western statesmen were still immersed in pleasant dreams, Douglas the engineer returned from a visit to Germany and warned his compatriots to get to their work benches and build fighters and bombers for all they were worth, as Nazi Germany was hopelessly outplaying them. A warning which led a Congressman to accuse him of "war-mongering." America refused to listen: but France ordered a substantial number of Douglas DB-7 medium bombers, an order which was taken over by the British after the occupation of France. Renamed the *Boston* by the R.A.F., the DB-7 played a very honourable part as a night fighter during the "Blitz" on Britain in 1940-41 and as a light bomber in North Africa, as well as a fighter with the U.S. forces under the designation A-20 *Havoc*. Its successor, the tireless B-26 *Invader* (originally the A-26), gained even greater fame and became the trump card of the Allies' tactical bomber fleet. Six years later it had still lost nothing of its aggressiveness and was used as a light bomber in the Korean conflict.

Another interesting point is that Douglas began working on a guided missile—the first in America—back in 1943, at about the same time as the German industry. While the V2 was being built on the Island of Rügen, the *Wac Corporal* experimental rocket was taking shape at Santa Monica (a combination of the V2 and the *Wac Corporal*, the *Bumper Wac*, set up an altitude record of 250 miles and a speed record of 5,000 m.p.h. in 1949).

*

However striking these achievements may have been, they pale before Douglas's most fabulous success, the twin-engined DC-3 which ushered in the modern age of air transport.

Early in the thirties, Transcontinental & Western Air Inc., today's Trans World Airlines, was getting tired of its "tin geese"—a name which its "Ford Trimotors" had earned because they were of all-metal construction and therefore unusual in those days. The performance of these aircraft was not equal to the stage lengths required in trans-continental operation. Their cruising speed was 120 m.p.h., their range 550 miles. But above all passengers arrived at their destination half deafened and completely exhausted. So TWA—always on the watch for modern equipment—was looking round for a new aircraft with what at that time was regarded as unattainable performance characteristics: increased safety and speed, considerably greater comfort, bigger payload... everything that was good and expensive. "Impossible," said the designers called in for consultation. Douglas thought otherwise. He realized, of course, that all these qualities could not be built into existing types. But if what was required could not be obtained by traditional means, then the aircraft design must be "revolutionized"—or, in other words, built up anew from scratch. This is what Douglas did.

To get a first-hand report on what was needed, he sent his chief designer by "Tin Goose" from West to East Coast. The result was crushing. The aircraft was involved in a stormy landing, during which the ventilation system was found to be expert at piping rain into the cabin.

Douglas' reaction to his chief designer's report was typical. The same evening, work

The *Cloudster*, first aircraft built by the Douglas firm, was designed for a trans-continental flight by sportsman David R. Davis.

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began on a new ventilation system. Sound-proofing specialists were set to design a new cabin. Meanwhile Douglas busied himself with the "rest". The result was not long in coming, and it was decisive. The DC-1 prototype was followed by the DC-2, one of which belonging to K.L.M. took first place in the transport section of the 1934 MacRobertson race from England to Australia (incidentally, a descendant of this aircraft, the DC-6A *Liftmaster*, won the transport section of the Harewood Gold Cup race between England and New Zealand for K.L.M. in 1953).

Despite this obvious success of the DC-2, the welcome accorded the DC-3 in the press was anything but enthusiastic. Forecasts are dangerous things. As a rule they should only be set down in print when it is quite certain they will not be seen by anyone twenty years later. General press reaction to the DC-3 in May 1936 was:

"The first DC-3, most advanced of the Douglas transport line, this month was placed in service with American Airlines.

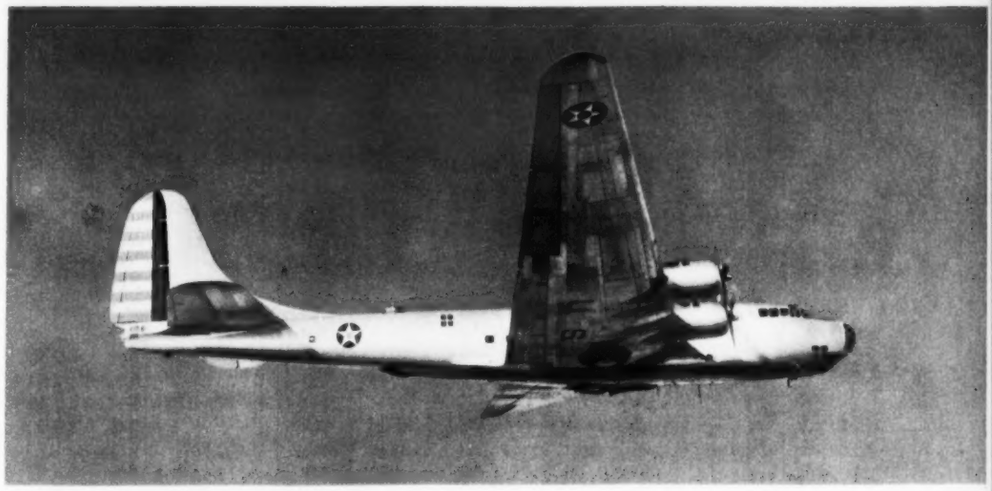
Although it is still not certain how many DC-3s will be produced at Santa Monica, depending, of course, on future orders, tooling plans call for production of a maximum of 50 from presently designed tools.

The estimate of 50 is regarded as being rather rash and some are contending that 25 DC-3s are the most that the market can comfortably be expected to absorb."

But the market, or rather markets throughout the world, actually took 11,000 DC-3's, 10,000 for military purposes—of which a large proportion were afterwards converted for civilian use—, 1,000 for civilian.

In a speech at Los Angeles in 1947 James M. Landis, at that time Chairman of the Civil Aeronautics Board, said:

"When the Board came into existence, it came in as of the time when the DC-3 was the outstanding air transport, and our map for years has been a DC-3 map."



A pioneering achievement in bomber design. Although the B-19 of 1941 was only an experimental prototype, it pointed the way for modern heavy bomber production.

Landis's words are only a sample taken at random from the chorus of thousands. A bibliography of the DC-3 would fill a whole library. DC-3, C-47, C-53, R5D, *Skytrain*, *Skytrooper*, *Dakota* . . . wherever route networks were to be set up, military transport tasks to be completed, critical transport situations to be overcome, the famous twin-engined workhorse was to be found under one or other of its many designations.

A. E. Raymond, Vice-President and Director, Engineering.

*

This aircraft, which made the name of Douglas Aircraft, is on the point of going down into history. Despite a post-war face-lifting in the form of the *Super DC-3*, it will shortly reach the retirement age. But memories of its performance are still so fresh that a British aeronautical engineer, for example, mentioned the DC-3 in December 1953 when criticizing present-day British transports.

"Although we want an airframe to last 40,000 flying hours without dangerous fatigue" he said, "we would compromise on 30,000 hours. I know that 30,000 hours is a great deal, but I would point out that there are DC-3s existing which have flown more than 40,000 hours, and have taken about fifteen years to do it."[1]

"... Constant development is the secret"

Just as the DC-4, four-engined sister aircraft to the DC-3, was getting ready for delivery to the airlines, World War II broke out, and the DC-4 was put into uniform. Re-equipped as the C-54 *Skymaster*, it carried troops and supplies over all continents and oceans.

During the war the Douglas plants delivered a total of 31,268 bombers and transports; 29,385 of these were for the American forces, 1,883 for the Allies. The following table lists American deliveries:

10,123	C-47 (DC-3) *Skytrain* or *Dakota* transports
6,043	A-20 (DB-7) *Havoc* ground attack bombers
5,559	SBD (A-24) *Dauntless* dive bombers
3,000	B-17 *Flying Fortress* long-range bombers*)
2,502	A-26 *Invader* attack bombers
1,162	C-54 (DC-4) *Skymaster* transports
962	B-24 *Liberator* heavy bombers**)
34	various, including experimental aircraft
29,385	

*) Under Boeing licence
**) Under Convair licence

Douglas's research and development division on untrodden paths: the X-3 research aircraft.

[1] From a paper by B. S. Shenstone, B.E.A.'s Chief Engineer, read to the Institution of the Production Engineers in Southampton on December 18th, 1953.

The bombers brought victory, peace and—lean years for the aircraft industry. Deprived of their military orders, firms had to concentrate on development of modern commercial models, which swallowed up princely sums without at first bringing any reward. Despite their international reputation and their uncontested efficiency, many of America's major aircraft firms got into serious difficulties. In some cases disaster could only be avoided through Government aid.

Douglas too had to put a lot of money into marketing his DC-6 and developing it into the DC-6A and DC-6B.

A particularly annoying fact was that the market for the DC-4 had been saturated by the Army Air Forces, who had dumped more than 300 of their C-54s at knock-down prices for scheduled and non-scheduled operators.

But Douglas was able to carry on without State aid. His solvency was beyond question, because Douglas Aircraft Co. had not become extravagant during the wartime boom. Its dividend policy had remained such a cautious one that stock market and public complained of penny-pinching. No matter how high sales and profits soared from 1942 to 1944, Douglas paid his shareholders $2.50 a year. Period. (Between 1950 and 1953, however, the dividend policy became considerably more liberal.)

As this table shows, the businessman in Douglas is as successful as the engineer. The result was a logical one.

Where did Douglas stand at the end of 1953? The report for the 1952/53 business year will not be available before March or April 1954. The latest financial appraisal of Douglas Aircraft was published by Standard & Poor's Corporation, New York, in October 1953, when it was estimated that income for the year ending November 30th, 1953 would be $14 to $15 per share, compared with $8.99 in 1951/52. On August 31st, 1953, Douglas held unfilled orders to the value of $2,100,000,000 (compared with $1,800,000,000 on November 30th, 1952). Summing up, Standard & Poor's described Douglas shares as "one of the better aircraft issues," and remarked that present orders will ensure full employment at least until the end of 1955.

Douglas today operate four plants. The main plant at *Santa Monica,* where chiefly military transports, airliners and guided missiles are built; *El Segundo,* near Los Angeles, entirely engaged on military and research aircraft; *Long Beach,* military production (transports and bombers); *Tulsa,* Oklahoma, licence production of Boeing B-47 bombers.

In the field of research and development Douglas continue to hold a leading place. An interesting point in the military domain is the entry of Douglas into fighter production. A substantial order for the new *Skyray* jet fighter was recently placed by the U. S. Navy. In the commercial field, development is leading, via the compound-engined DC-7 and DC-7B, to the DC-8 jet transport.

Yet despite his readiness to venture into new lines of development, despite daring advances into new scientific territory, the "conservative revolutionary" remains true to his old principles, which he described fittingly in 1935 when he was awarded the annual Collier Trophy for the most significant contribution to aviation. On receiving the Trophy he said:

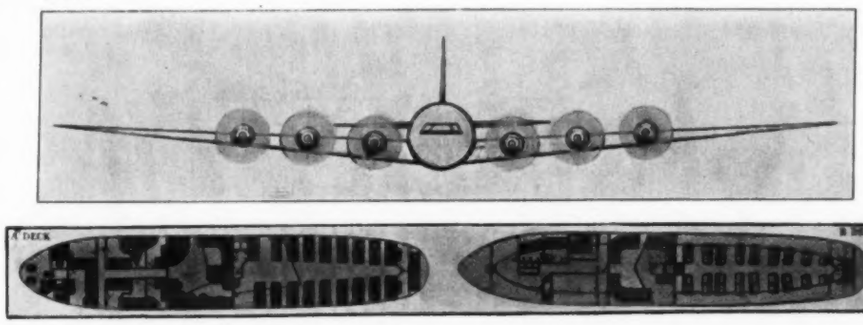
"There is nothing revolutionary in the airplane business. It's just a matter of development. What we have today is the Wright Brothers' airplane, developed and refined. But the basic principles are just what they always were."

Douglas Aircraft Co.'s sales, profits and dividends, 1929 to 1953 (business year December 1st to November 30th).

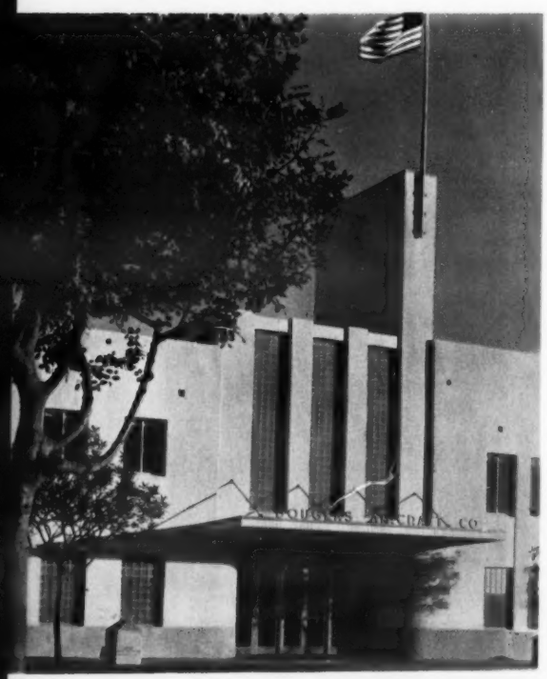
	Sales Million $	Income Million $	Earnings per share $*	Dividends $*
1929	2·55	0·40	0·60	—
1932	2·32	0·07	0·10	0·44
1937	20·95	1·08	0·95	—
1938	28·35	2·15	1·88	1·50
1939	27·87	2·88	2·41	1·50
1940	60·97	10·83	9·03	2·50
1941	180·94	18·18	15·15	2·50
1942	489·78	9·23	7·69	2·50
1943	987·69	5·95	4·96	2·50
1944	1,061·41	7·69	6·41	2·50
1945	744·68	8·96	7·47	2·50
1946	106·72	2·18	1·82	3·75
1947	128·46	(L)2·14	(L)1·79	1·25
1948	118·58	5·83	4·86	2·50
1949	117·42	5·52	4·60	4·63
1950	129·89	7·21	6·01	3·13
1951	225·17	6·91	5·76	3·50
1952	522·62	10·79	8·99	3·75

* Including free bonus share issue in May 1951.
(L) Loss

When Pan American World Airways called for designs for an Atlantic aircraft, the *Yankee Clipper,* in 1937-38, only one of the five projects submitted was a landplane — the one put forward by Douglas Aircraft Co.



Entrance to Douglas main plant, Santa Monica.



Current assets, current liabilities and price range of shares.

	Current assets Million $	Current liabilities Million $	High	Low
1941	59·81	35·38	39 5/8	29 5/8
1942	112·87	78·65	35 3/8	25 1/2
1943	163·46	123·03	36 3/4	22
1944	123·02	73·84	36 1/4	23 1/2
1945	132·73	68·45	50 1/4	32 1/2
1946	82·90	24·41	54 3/8	31 3/4
1947	79·87	23·85	38	22 5/8
1948	82·70	24·09	33 7/8	23 1/2
1949	80·92	23·16	36 5/8	24 1/4
1950	83·79	25·54	48 1/2	34 1/2
1951	139·89	90·43	66 7/8	43 1/2
1952	210·01	160·75	65 1/2	52
1953*	193·84	140·07	74 5/8	60

* At August 31st, 1953.

"Super-Connie" in Production

Projected in June 1939, nearly fifteen years ago, and first test flown on January 9th, 1943, the Lockheed *Constellation* designed by Clarence L. Johnson has been one of the most successful transport aircraft in the world. The L-49 (or XC-69) prototype was first developed into the C-69 military transports, of which about twenty were built, then into the first civil L-49 (A to D), the L-149 interim version, and finally the heavier and more powerful L-649, L-649A, L-749 and L-749A[1]. They have made more than 50,000 Atlantic crossings and innumerable flights throughout the globe.—Their normal range is about 3,900 miles. But at the end of 1953 a Panair do Brasil *Constellation* (doubtless with auxiliary tanks) covered the 4,802 miles between Lisbon and Rio de Janeiro in 19 hours non-stop.

[1] Cf. also *Interavia, Review of World Aviation*, "From *Constellation* to *Super Constellation*" (No. 11, 1951, pp. 628–629) and "Connie Courts the Customer" (No. 1, 1953, pp. 40–42).

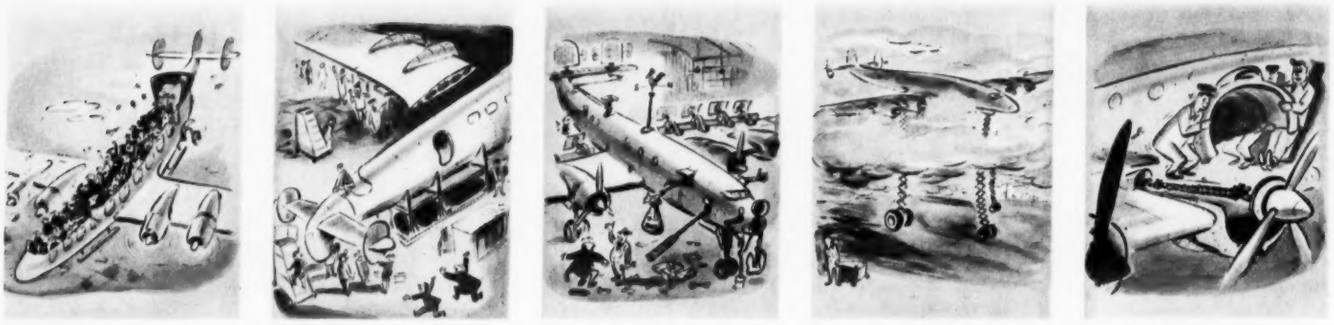
Ten years after the first design Lockheed decided on a radical modernization of the *Constellation*. They cut the fuselage of the original XC-69 into three and "streched" it by no less than 18 ft 4¾ ins. to accommodate from 47 to 63 first-class passengers or 94 tourist-class passengers. At the same time Wright *Turbo-Cyclone 18* compound engines delivering 3,250 h.p. for take-off replaced the earlier Wright *Cyclone 18s* (2,200 or 2,500 h.p. for take-off), and the wings, undercarriage and engine supports were strengthened accordingly.

Thus was born the L-1049 *Super Constellation*, the C and E commercial versions of which are today used by 18 airlines throughout the world. It still has the same span (123 ft.) and wing area (1,650 sq.ft.) as the original model, the same characteristic fuselage line, the same tail unit. Its gross weight, however, has grown from 86,250 lbs. (L-49) to 133,000 lbs. (L-1049-E), and its cruising speed (at 75% METO power) has risen to 331 m.p.h.

How aircraft of more than 130,000 lbs. gross weight are produced is shown in the pictures on these pages. At the beginning of 1953 *Lockheed Aircraft Corporation* employed a total of 4,000 engineers and 44,000 skilled workers, assistants and administrative personnel at its main plant in Burbank, the branch plant leased at Marietta, Georgia, and other factories. In 1952 sales (90% of them military) totalled $438,122,000, net profit after taxation $9,058,000. Present order backlog is estimated at $2,000,000,000.

Lockheed's Engineering Building is nearly 400 ft. long and covers four floors. It houses 1,800 design employees (about half the engineering staff). In the A-bomb-proof basement there is a battery of electronic calculators. The picture below shows one of the drawing-board areas.

The 33,000 employees of the Californian division work at several different plants in Burbank, the largest of which (top picture) is situated alongside the firm's own airport, *Lockheed Air Terminal*. (Ten American airlines regularly use this field.)



FUSELAGE | WING AND EMPENNAGE | SURFACE CONTROLS | LANDING GEAR | POWER PLANT

Parts production and preliminary assembly

The multiplicity of parts, sub-assemblies, assemblies, components, vendor parts and equipment, with which Lockheed's responsible production chiefs—B.C. Monesmith and G.A. Fitzpatrick at Burbank, for example—have to deal, is illustrated in the above row of cartoons drawn by Shaw for Lockheed's "Super Constellation Pocket Hand Book." They caricature ten of the most important functional elements in the aircraft.

Drawings and diagrams for the *Super Connie* and the endless parts lists would fill volumes, not to mention the countless detail drawings for the 102,000 parts (apart from rivets, screws and bolts). For example, the equipment list for the two radio panels in the cockpit contains 80 items alone. Then there are no fewer than ten aerials (VHF, 2×HF, 2×ADF, 2×UHF altimeter, ILS, VOR, Marker), the air-conditioning system comprises ten pressurizing units, five cooling and refrigeration units, three ventilation units, ten main heating units . . .

All equipment items, engines, propellers and other finished parts are purchased from specialized manufacturers, and a great many AN (i.e. standard) parts, cast members, tanks, conduits, etc., are made by sub-contractors, but Lockheed itself builds the majority of airframe parts in its own plant. In addition to the cutting machines (lathes, milling and boring machines, grinding machines), etc., required for cutting compact parts (spar webs, fittings, etc.), there are huge sheet metal machines for shaping skin panels, stringers, bulkhead segments, ribs, etc.

A few years ago Lockheed installed a considerable number of super-heavy stretch presses, hydraulic presses and drop hammer stamp presses in their new "Hall of Giants" (bottom picture)[2]. As very much thicker sections are required than a few years ago, to make sure of accurate airfoil shape and surface finish in high-speed aircraft, these machines—as our pictures show—are no longer merely formers. Some of them are cutters.

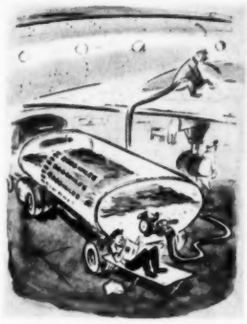
Built up of tens of thousands of individual parts, the main assemblies of the aircraft—fuselage, wing, empennage—gradually take shape on giant assembly jigs in the preliminary assembly halls shown here.

[2] Cf. also "Machine Tools for Defence", *Interavia* No. 4, 1952, pp. 205 – 210.

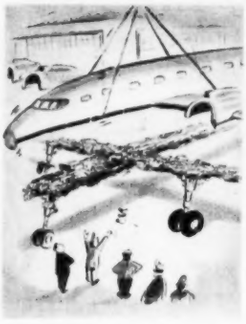
Thick aluminium alloy plates for the *Super Connie's* wing skin, 32 ft. long, 4 ft. wide and weighing 3,200 lbs. are "sculptured" down to only 389 lbs. on the Giddings & Lewis skin mill shown below (extreme left) to form "integrally stiffened" panels. The result is high surface smoothness and stiffness for the wings.

Thin light metal sheet for the fuselage skin is shaped on the 200-ton Hufford stretch-wrap press (shown below, centre of picture), then attached by means of snap-on fasteners to a network of ribs and stringers and finally riveted – largely outside the assembly jig. Eagle-eyed inspectors check every detail of production.

Sheet parts of double curvature, such as the forward part of the wing root fairing, are shaped by drop hammer presses (a Chambersburg-Ceco 20-ton stamp press can be seen on the right in the picture below) or on hydraulic presses, and joined to the rest of the sub-assembly in special jigs. Smaller sub-assemblies are produced at Bakersfield and Beverly Hills, as well as at Burbank.



FUEL AND OIL SYSTEM



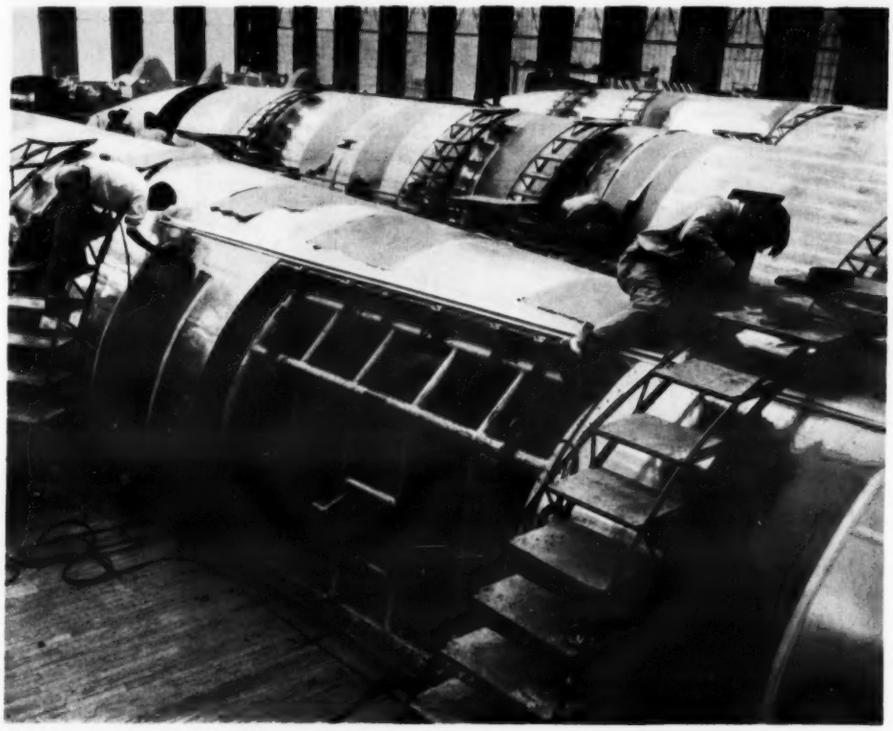
HYDRAULIC SYSTEM

ELECTRICAL SYSTEM

AIR CONDITIONING SYSTEM

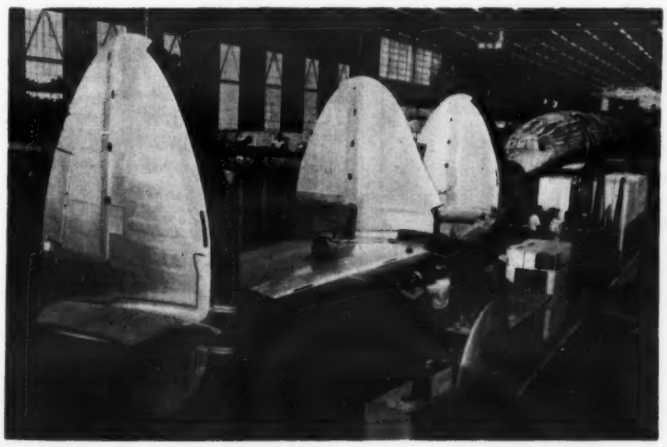
UTILITY SYSTEM

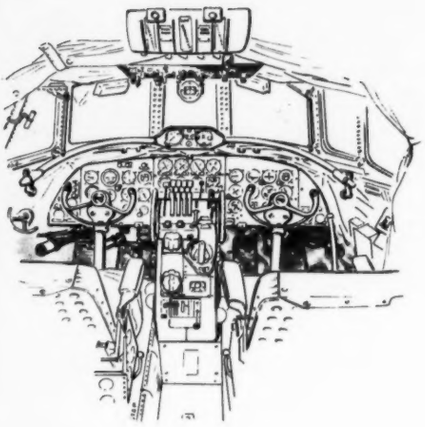
Fuselage production: Fabrication specialists are joining the outer skin and floor supports to the structural members of the *Super Connie's* fuselage. Sections in the background are being built on vertical jigs, with "two-stories" work, which increases production speed. Picture on the right shows assembly of fuselages in horizontal position with curved ladders to provide access to work areas. Heavy paper protects the skin from scratches and other surface damage.



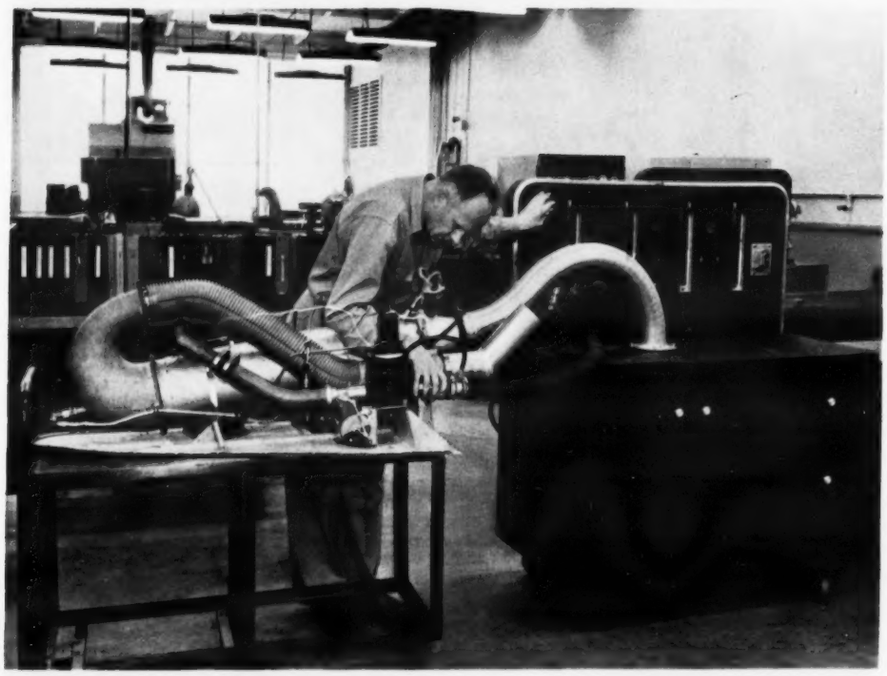
Empennage production: The men fitting de-icer boots look like dwarfs against the *Super Connie's* tremendous triple-fin tail unit (the horizontal stabilizer spans 50 ft.). The vertical tail area has been increased over that of previous models, yet maximum over-all height of the plane is only 24 ft. 9 ins., providing generous clearance for the tail at hangas doors.

Wing production: Inner wing sections on the production line, where they are fitted with engine mountings, control rods, tanks, de-icers and landing flaps. They then move on to the final assembly line in the background. The short outer wings (complete with ailerons) and wing tips are built on separate assembly lines and not attached to the inner wings until final assembly.





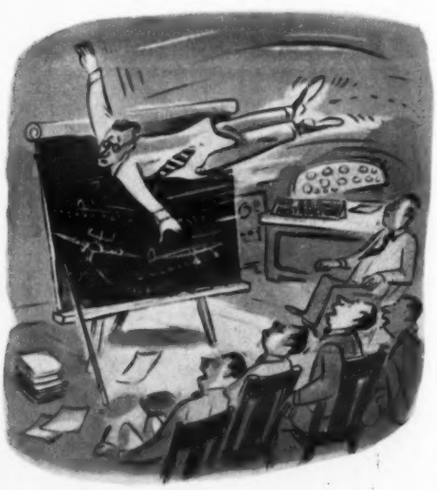
Pilot's cabin: dual control columns and pedals; throttle levers, trimming levers and automatic pilot on the centre pedestal, fuel pump valves overhead . . . and a galaxy of flight and navigation instruments.

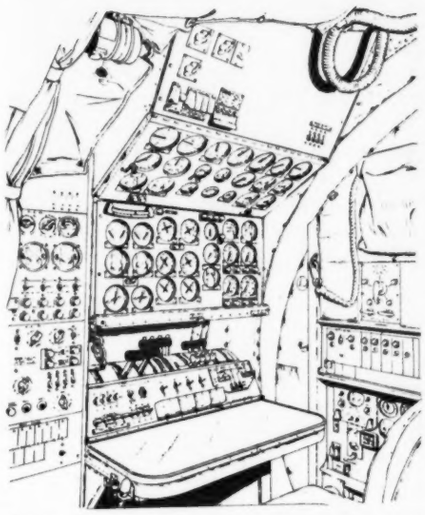


Final assembly

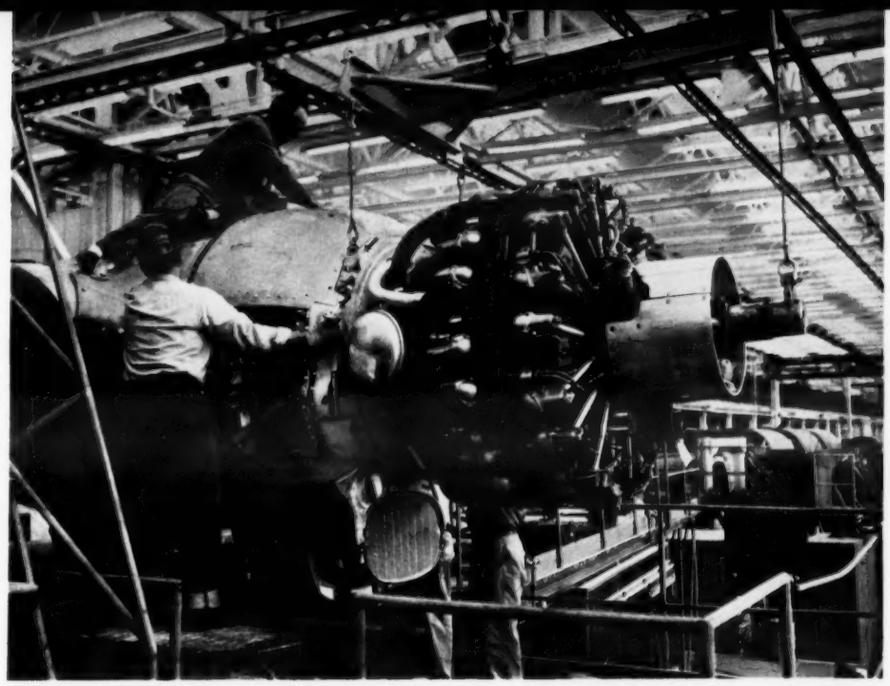
Although up to 43 sets of fuselages, wings and empennages can be assembled at the same time, there is only room for the final assembly of six of the huge aircraft at any one time. To avoid hold-ups, final assembly must therefore be as rapid as possible. In essentials, it consists of the mating of finished components under the most stringent control. All time-consuming installation work, e. g. checking (centre picture) and fitting of heating equipment or installation of cables in the fuselage (bottom picture) and the wing, is done before the final assembly stage. Most work on the electrical system, which demands great patience and dexterity, is done by women, who get the same rates of pay as their male colleagues. Photographs of the finished system, in addition to

Operating instructions . . . this is how to fly the *Super Connie!*



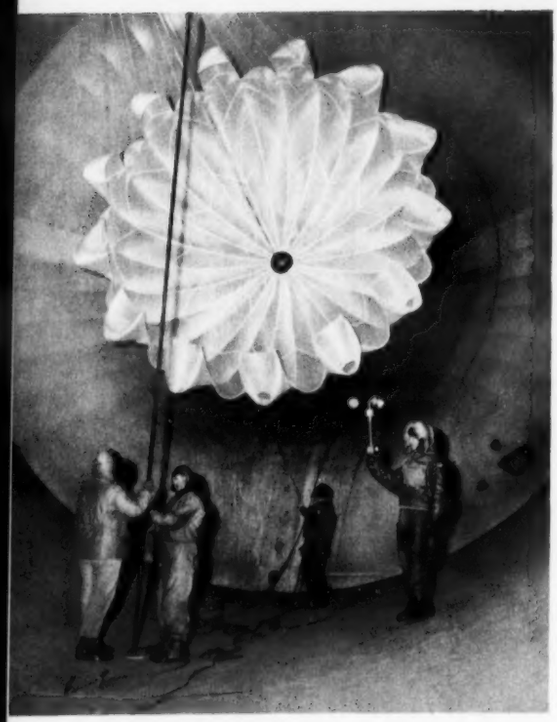


Flight engineer's desk; all engine instruments and a second set of control levers; endless switches and instruments for the electrical and hydraulic systems, air conditioning, de-icing, etc.



the usual blueprint wiring diagrams, are used for this difficult work.

A series of overhead cranes (capacity up to 45 tons) is used to move inner and outer wing sections, empennage and engines up to the assembly line and to set them down at exactly the right spot. One of the three exhaust turbines on the 3,250 h. p. Wright *Turbo-Cyclone* compound engine is discernible in the top right picture. These increase engine power by 20 % and reduce specific fuel consumption. The main undercarriage, complete with double wheels, tyres and hydraulic brakes, is hoisted into position for its attachment to the inboard engine nacelles. Finally, engine cowlings and the mighty propellers—15-ft. Hamilton Standard reversible pitch airscrews with fluid de-icing—are added.—*A new Super Connie is ready to leave the factory for its acceptance flights.*



Wind tunnel experiments (here on the model of a Pioneer guide surface parachute in the *Massie Memorial Wind Tunnel*, Wright Air Development Center) play a decisive part in American parachute production.

Parachute Development in the United States

FROM A LECTURE BY DR. H. G. HEINRICH

Several months ago Dr. H. G. Heinrich gave a lecture in Düsseldorf at the invitation of the North Rhine-Westphalia Transport Minister, on parachute development in the United States. During World War II Heinrich, a member of the Graf Zeppelin Research Institute in Germany, made a notable contribution to aerodynamic and structural research for the German parachute industry, which at that time was working largely on a trial and error basis. In 1945 the United States Government invited him to continue his work at the *Wright Air Development Center*, where he found almost unlimited research equipment. He is today one of the leading parachute engineers in the United States.

For German listeners it was particularly interesting to learn how some of the ideas conceived in Germany had developed during the intervening years in America and how long had been the road—as is nearly always the case in engineering—from the idea to operational use.

The lecture began with a review of historical development, which revealed the *great variety of parachute types*. Two features were shown to have been of decisive importance: *porosity*, which has led from the normal fabric envelope to the highly porous ribbon and annular slot parachutes: and *shape*, from the usual flat parachutes of circular, triangular or rectangular cut, via the various dome shapes to the latest guide surface parachutes. Though a number of minor modifications to shape and porosity have given rise to a multiplicity of types, they have not produced any outstanding new effects. New shapes therefore had to be found for today's uses of the parachute.

In the United States this development has been backed by a rich research programme. Aerodynamic considerations naturally formed the basis, since the first question always concerns the flow configuration. In the case of parachutes it is practically impossible to determine flow theoretically, because of the marked turbulence. Flow configurations are therefore generally obtained experimentally, by the petroleum-cum-lampblack process. Wind tunnel investigations played a decisive part, and a number of full-size personnel parachutes have been tested in the tunnel. For the large chutes "bodies" were used, and the opening process, stability and resistance of the parachute were measured by instruments and recorded on magnetic tape recorders. For very high test speeds a rocket-powered sled was built, capable of reaching almost double the speed of sound on a 2-mile rail track in the California desert. The parachute was released at the required speed and its behaviour automatically measured. The final, decisive test, however, was always from an aircraft under the most stringent conditions possible, with the user's observations and instrument readings being carefully collected and interpreted.

The remainder of Dr. Heinrich's lecture was devoted to the two critical phases in parachute operation: opening and landing.

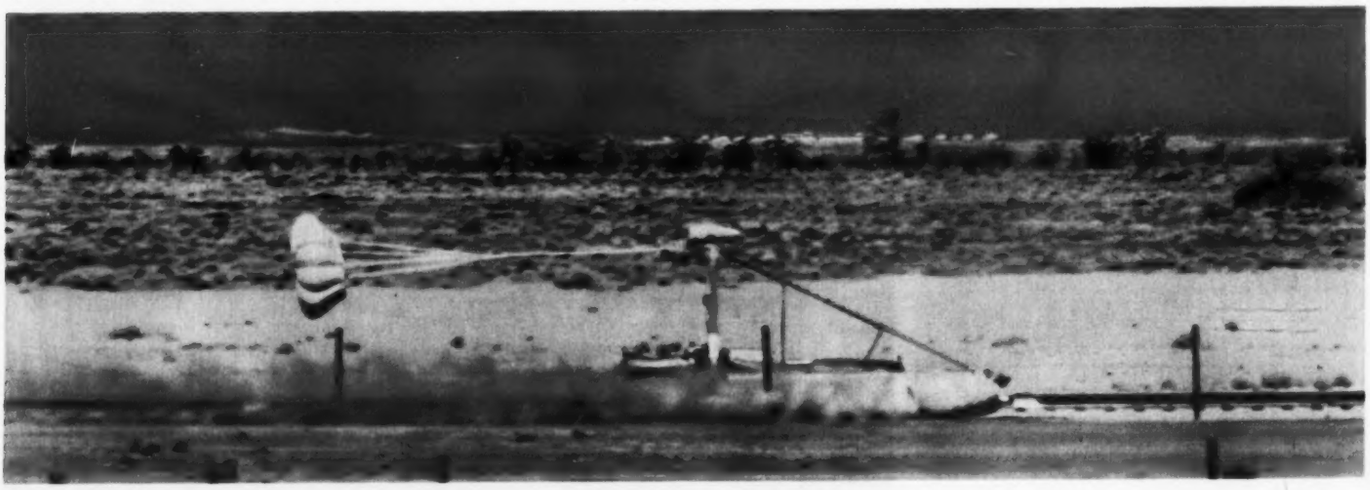
*

One of the problems involved in *safe opening* is the *magnitude of the opening shock*. For example, a standard plane parachute would exert a pressure of 5,300 lbs. on the user at a speed of 350 m.p.h., while the new American life-saving parachute produces a maximum force of only 3,200 lbs. at the same speed, or 3,700 lbs. at 400 m.p.h. As decelerations of more than *20 g* may have fatal consequences, it is obvious that the standard flat parachute cannot be used for life-saving purposes from high-speed jet aircraft.

The opening shock depends on the *drag coefficient*, the so-called *apparent mass* and the *filling time* of the parachute, which in turn are determined by the *shape and porosity of the envelope*. These values can only be obtained by experiments.

Apparent mass: every body in non-uniform motion produces—in addition to its frictional drag—a dynamic resistance when it is accelerated and a dynamic thrust when it is decelerated.

North American Aviation Inc. have developed a rocket-driven sled for extremely high test speeds, which can reach twice the speed of sound within 4.5 seconds when used empty.



During the opening of a parachute, not only the latter's own mass but also a certain mass of air carried along with it become active dynamically. The effect is the same as if the parachute had a higher mass. Consequently the dynamic effect is expressed mathematically as that of an "apparent mass." Some opening theories—for example those propounded in Germany by *Weinig* and *Scheubel*—use as apparent mass of the parachute the value of an air-filled sphere of the same size, or a multiple. On the other hand, friction, porosity of the fabric and shape of the envelope may not be ignored.

Heinrich therefore based his experiments on a proposal by *von Kármán* that half of the appended weight of a parachute descending at a constant rate should be dropped, and the deceleration of the remaining system and hence the parachute's "apparent mass," measured. In these experiments parachute models measuring 5 ft. in diameter were used. It was found that in normal parachutes the "apparent mass" is only half as great as the enclosed air mass, while in a guide surface parachute of closely woven fabric it is about 15% greater than the latter. Experiments with full-size parachutes are being prepared.

Filling time and porosity: While normally porosity is defined by the volume of air passing through a unit area in a unit period of time at a given pressure differential, in the theory of the opening process it is the *ratio between outward and inward flow speeds* that is used. This is designated "effective porosity." As tests have shown, the properties of the fabric vary under the effect of pressure and thus influence the filling time. Only when the deformation of the fabric is complete, does the latter acquire a practically constant resistance. Effective porosity thus determines filling time, and the latter has a decisive effect on opening shock.

Effective porosity also decreases with the square root of the atmosphere density. The parachute is thus less porous at high altitude than near the ground. It opens much faster, and the opening shock is considerably greater. Experiments with an American parachute type gave an opening time of $^1/_{10}$th sec. at 40,000 ft., compared with a full second near the ground (in both cases with the same dynamic pressure). The opening shock of this parachute rose from 1,720 lbs. at sea level to 6,400 lbs. at 40,000 ft. The earlier general assumption that opening shock would diminish with decreasing atmospheric density was thus proved to be false.

Finally, the so-called *throttling effect* may disturb the unfolding of the parachute. As the envelope begins to fill, the lower part forms a narrow tube through which air flows into the upper balloon-like portion. In this condition the loose fabric flutters about uncontrollably between the shroud lines, which speeds up or slows down filling and makes the parachute opening unreliable. Uncontrolled fluttering may cause very great variations in opening characteristics.

The problem of safe landing is primarily one of the *stability* of the parachute, i.e. of the phenomena of "swinging" and "gliding."

If the behaviour of a parachute is observed with the naked eye, the "swinging" is seen immediately, but not the "gliding." The error has therefore frequently been made of calling a parachute "stable" simply because no swinging was observed. The user then suffered serious injuries, obviously caused by the gliding movements. Only theodolite measurements of the descent, or three-component measurements in the wind tunnel can show whether a parachute is stable or unstable. To ensure stability a certain porosity of the fabric is necessary, though slight swinging is acceptable—to save packing volume and weight—provided there is no sideways movement.

Wind tunnel measurements also showed that the *guide surface parachute* (Pioneer) provides the best stabilization. Close behind comes the U.S. Air Force's new personnel parachute. The ribbon parachute, hitherto thought to have the best stability, lies somewhere between the new guide surface and the new personnel parachute.

*

An interesting point is that there are at present two "schools" of parachute development. The one places the main stress on varying *porosity* (and on a limited geometric variation in the cut of the envelope), the other gives preference to the *shape* of the envelope in unfolded condition. The first school is represented typically by the ribbon parachutes and the annular slotted parachute. Examples of specially shaped envelopes are the guide surface parachutes. However, the demand for reliable opening and stable behaviour sharply limits the variations in porosity, while variations in shape are virtually unlimited.

In particular the new Pioneer P7-B personnel parachute is the result of the combined use of interference drag, stabilizing surfaces and controlled throttling effect. This parachute can be used without difficulty at *speeds of up to 400 m.p.h.* Of all the personnel parachutes known today, it has the lowest opening shock, has practically no swinging and no sideways movement. With the same weight and pack bulk as a normal personnel parachute, it also has the same rate of descent. The safety of the new parachute has been proved conclusively by more than 800 experimental jumps, during which no injuries were sustained. Roughly 80 per cent of the users were even able to remain on their feet after landing.

Test jump with Pioneer's P7-B non-gliding guide surface parachute.

The user lands upright on his feet.

Of particular importance in this connection was Dr. Heinrich's view that a return to the conventional parachute types of the last war would save a little weight, pack volume and manufacturing cost, but only at the expense of greater danger to the user. The high opening shock and the rough landing would severely injure or even kill a considerable percentage of users. A tragic proof of this is provided by the catastrophe at Neuruppin (August 1953), when 17 men were killed and 27 severely injured during a mass jump by People's Police and Russian paratroops.

*

Detailed experiments with escape systems for use at supersonic speeds are also being made in the United States. Though it should be possible to make stable parachutes with low opening shock for supersonic speeds, it will be some time before such rescue equipment comes into practical use.

P. R.

THE FOLLOWING OBITUARY FOR DR. ALBERT PLESMAN BY THE EDITOR IS REPRINTED FROM INTERAVIA AIR LETTER NO. 2875. ED.

Albert Plesman

It was in 1927 that I first met him. To me it seems like yesterday. A corner building in The Hague housed the very modest offices of K.L.M. Royal Dutch Airlines. Just inside was the passenger lobby, whose chief ornament was a Fokker model aircraft hanging from the ceiling. On the right was the office of Albert Plesman, Managing Director, on the left that of his first assistant, Hans Martin. Then there were a few other offices, where "foreign relations officer" De Vries and other members of the staff worked.

In 1947 Plesman proudly showed me round the almost completed Hague building with offices for several thousand employees, several wings, canteens for the staff, a restaurant for the management, another for passengers, gymnasiums, and everything else. K.L.M. had become a big concern.

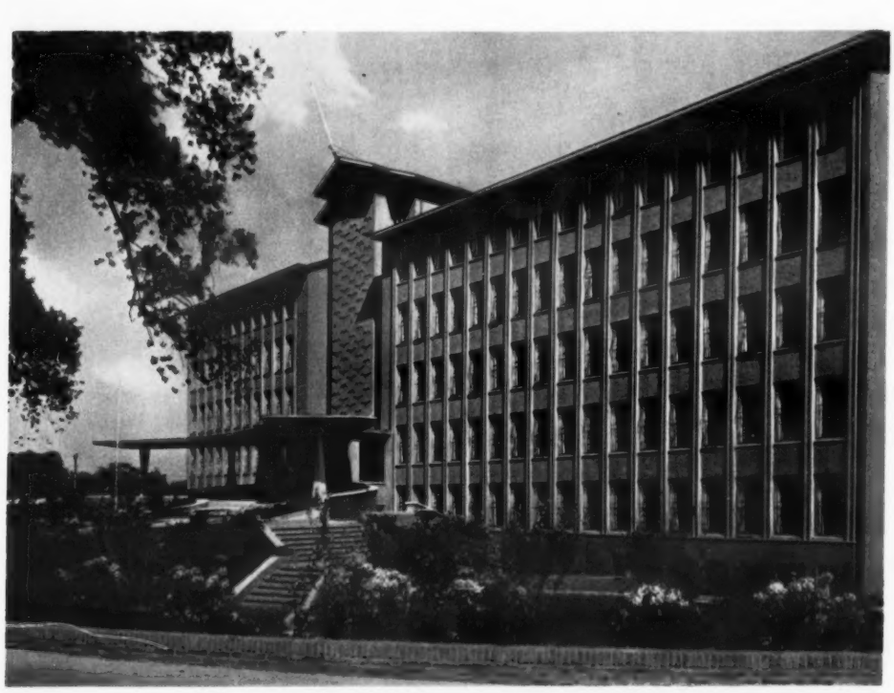
The last time I saw Dr. Plesman was in the late summer of 1953. For months there had been rumours that he, his health undermined, was planning to lay down the heavy burden of President of K.L.M. on January 1st, 1954. I knew him well enough to ask him if this was really his intention. He stoutly denied any such thought. But fate willed otherwise. At midday on December 31st he suffered a haemorrhage, was rushed to hospital and died in the evening, without regaining consciousness.

With Albert Plesman has vanished one of the great architects of today's commercial aviation. He has left on it his own particular stamp and had for it a flair such as few possess. His untamed energy impressed the onlooker as almost superhuman. A national figure, he is today mourned by the whole of Holland.

*

Born at The Hague on September 7th, 1889, Dr. Plesman was the seventh child of a Dutch middle-class family. In his early youth he decided to make a military career. A second lieutenant in the infantry in 1911, he instinctively became interested in aeronautical matters in the early years of aviation. In 1917, shortly after his marriage, Plesman saw the fulfilment of one of his most cherished dreams: he obtained his pilot's certificate and was promoted to Lieutenant in the Air Corps. His flair and energy were again manifested shortly after the end of World War I, when, in 1919, he inaugurated the first aeronautical exhibition to be held in the Netherlands (E.L.T.A.), and in the same year, on October 7th, with the support of a small number of enthusiasts, founded the Koninklijke Luchtvaart Maatschappij, the K.L.M. destined to become later an international transport instrument of world renown under his continuous administration.

Plesman's initiative was seconded only by his luck. His technical equipment was created for him by his compatriot, Anthony Fokker. Both Britain and Germany gave every encouragement—under the transport policy of the time—to the youthful Dutch airline concern. Together with Britain's Air Marshal Sir Sefton Brancker and the Germans' Brandenburg, Milch, Wronsky and von Gablenz, he helped to create the first I.A.T.A., the International Air Traffic



K.L.M.'s head offices in The Hague.

Association, and to make The Hague its headquarters. Plesman's closest collaborator, Hans Martin, laid the foundations for K.L.M.'s services to Indonesia; his "right hand," de Vries, was successful in concluding the most favourable bilateral air agreements, with considerable diplomatic ingenuity, with all kinds of foreign partners.

Nor did his instinct for progress and innovation ever fail him. He was amongst the first in Europe to recognize the value of the Douglas DC-2 twin-engined transport, with which he won the London–Australia handicap air race in 1934. He also introduced the type, later to be superseded by the DC-3, with outstanding success on K.L.M.'s services to the Far East. Plesman was able to compete successfully with all, both on overseas and European services.

*

With the beginning of hostilities in World War II, K.L.M. was—to all appearances—condemned to total inactivity. Initially, it is true, old-standing relations with neighbouring Germany proved to be of some advantage. But when Holland herself became involved in the war in 1940, and Plesman recognized the fallacy of National Socialist doctrine, the breaking point was reached. In 1941-42 Plesman himself was imprisoned; his eldest son joined the Allies and became a Flight Lieutenant with the R.A.F. On his release from prison, Plesman lived in relative retirement in the eastern Dutch city of Twente, where together with Hendrik Veenendaal, his technical adviser, he drew up plans for the new K.L.M. With the liberation of Holland by the Allies, his plans began to bear fruit. He placed an order for the first fourteen C-54 *Skymasters* (Douglas DC-4s) as early as 1944, shortly to be followed by orders for the first Lockheed *Constellations*, Douglas DC-6s and Convair twin-engined transports—on a scale which, for Holland, was unusual to say the least. K.L.M. arose greater than ever. Plesman's luck held good, and in 1945 he created the first airlift for his country, involved in the Indonesian conflict and with her shipping gone. He became a Dutch national hero. At his death K.L.M. had a fleet of some 90 modern aircraft, with which it operates a world network to and in all continents. With a staff of nearly 14,000 it is an air power whose international importance is evidenced by the fact that Prince Bernhard of the Netherlands is Chairman of the Board.

All this was Plesman's own work.

1919: Lieutenant Albert Plesman (left) visiting the first Dutch air exhibition (E.L.T.A.) in the company of H. M. Queen Wilhelmina. Soon afterwards, on October 7th, 1919, he founded K.L.M.

*

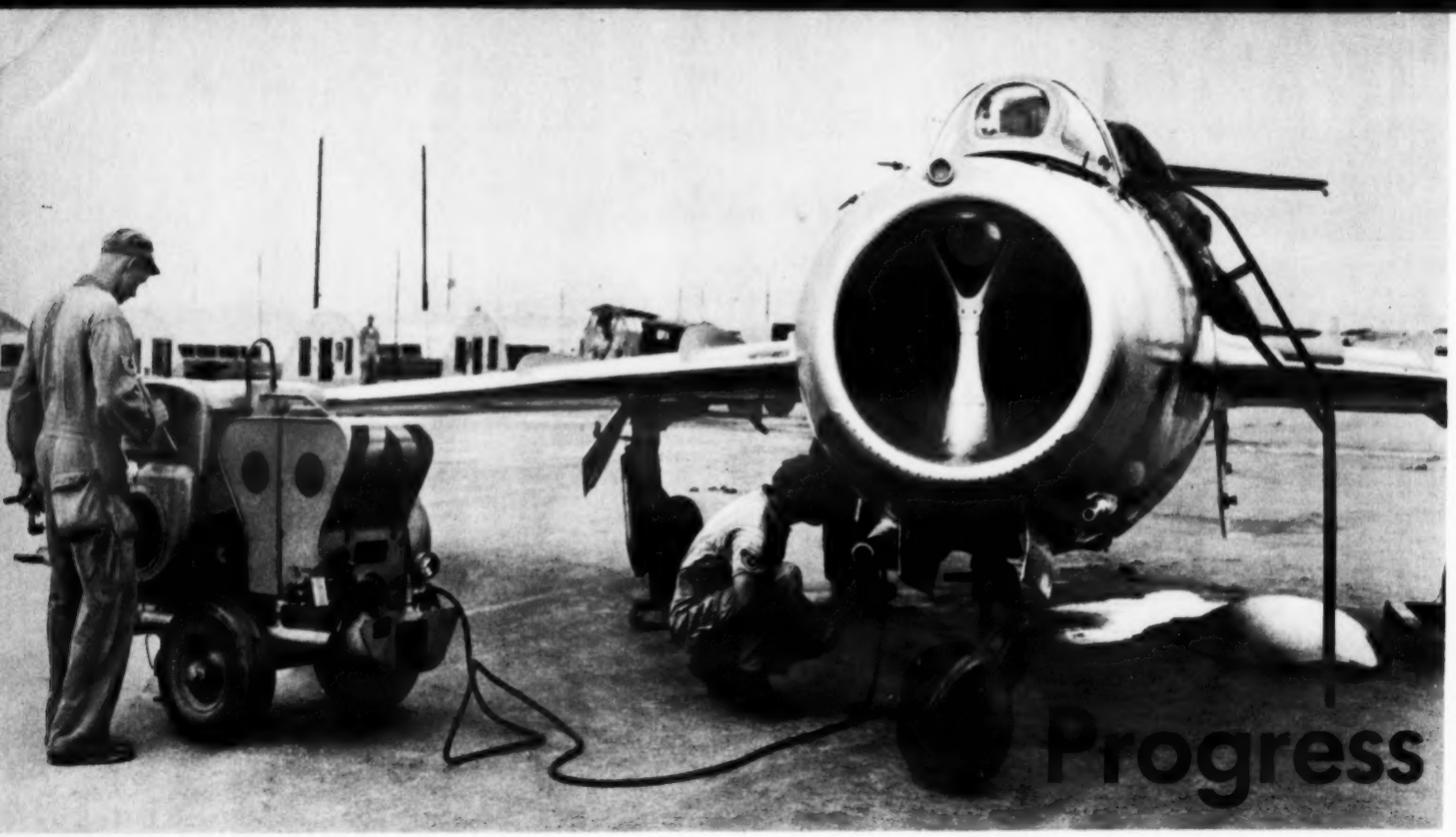
Who is to succeed this giant? Martin and De Vries left the company long ago, but there are others still left. Will General Aler, until recently Commander-in-Chief of the Dutch Air Force, become the new President of K.L.M., or is he being reserved for the command of an E.D.C. air force, as many believe? Will Plesman's successor be a man from his own entourage or an outsider? The question has not yet been decided. However it is solved the new man will have no easy task. Plesman was not only a brilliant man and an autocrat, but he made his K.L.M. into one of the most energetic airlines in the world, fearing no competition but gladly answering any challenge. It was not for nothing that Plesman always demanded absolute freedom of the air, the so-called "Fifth Freedom." It was not for nothing that in recent years he had fought for international co-operation, in which in his sub-consciousness he surely foresaw a leading role for K.L.M. Inevitably he became a great European.

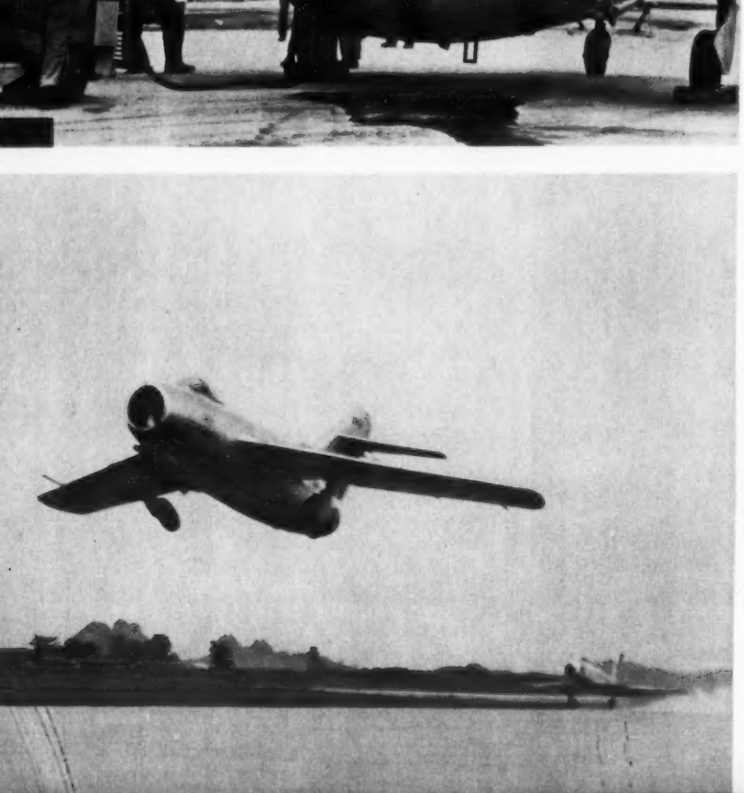
*

Such is the picture of the man who, from small beginnings, became a personality of world stature, who built up from the most modest origins a firm which today enjoys world renown. Many external honours were bestowed upon him, but fate willed that he, a devoted father and warm-hearted man despite his sometimes outward roughness, should lose two of his three sons to flying, one in the R.A.F. during the war and the other over Southern Italy. He was never able to overcome these blows.

His death leaves behind a gap, not only in Holland. So enterprising and fruitful a spirit is not given to the world every day.

Two "flying Dutchmen": Albert Plesman with Anthony Fokker, the Dutch aircraft designer and manufacturer, who provided the technical equipment with which K.L.M. was built up.





Production progress in Russia too . . .

In the assumption that the "rightful owner" of the North Korean Mikoyan MiG-15 jet fighter, which landed at Kimpo Air Base, South Korea on September 21st, 1953, might come forward at any moment, U. S. Air Force experts have lost no time in subjecting their "loan" to thorough inspection and flight testing on Okinawa. A group of these experts, including Major General Albert Boyd, Major Charles E. Yeager and Captain Tom Collins, immediately flew out from Wright Field, Dayton, Ohio, to the Pacific island. Then early in January, 1954, the MiG-15 was taken to the United States.

The very sparse information issued by the U.S. Far East Air Force reveals that the MiG-15 first came off the production line at the end of 1951. The pictures on this page show interesting structural details, especially a landing searchlight in the lip of the air intake aperture and four boundary layer fences on top of the wing, running back to the trailing edge. Surprisingly enough dive brakes are fitted at the rear of the fuselage (added later?), but neither elevators nor rudder have trimming tabs and the tailplane is not adjustable.

Compared with the Russian fighters of World War II, the MiG-15 shows very clean finish, especially considering that it is built in large numbers. Russian engineers and technicians have obviously learned a good deal. Arrangement of the rows of rivets, cover plates etc., are strongly reminiscent of German metal aircraft production at the end of the war. Surface quality—of decisive importance in a near-sonic fighter—does not, however, come up to the present standard in the Western aircraft industry, especially as only thin metal skin, stiffened by ribs, bulkheads and profiles, is used. Russia's radio equipment industry also appears to be behind the West's. Otherwise it would be difficult to explain why this high-speed fighter should have an outside R/T aerial.

In comparative flights with a North American F-86 *Sabre* the MiG-15 proved to be slightly slower. American pilots who have flown it also complain of the lack of powered controls, which means that a MiG-15 pilot has to give too much of his attention to pure piloting and has not enough left for his tactical duties. Other shortcomings listed in the American reports include inadequate stall warning, lack of space and fatiguing lack of comfort in the cockpit, bad heating and ventilation.

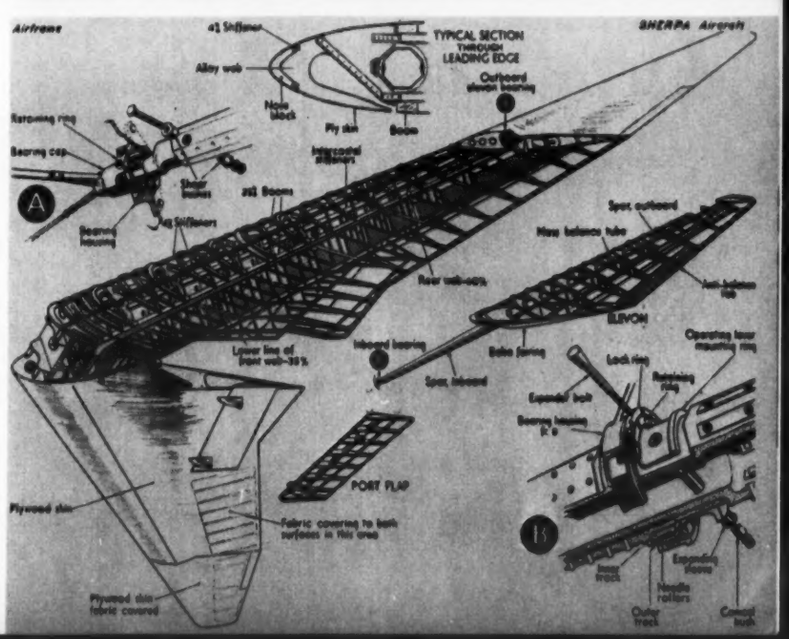
Short SB.4 Sherpa

The Short SB.4 *Sherpa* experimental aircraft with "aero-isoclinic" wing* was shown to the public for the first time at Aldergrove, Northern Ireland, on December 4th, 1953.

After the demonstration Short's Chief Designer David Keith-Lucas stated that the tailless layout and "aero-isoclinic" wing embodying rotating wing tip controls (cf. photos and sketch) overcome the disadvantages in high-speed high-altitude flight of elevator and aileron reversal, aileron yaw and rolling movement due to side slip. The "aero-isoclinic" wing would be particularly suitable for long range at high altitude, though it could also be used for high speed at low altitude. It is thought that the "high altitudes" referred to by Keith-Lucas are well in excess of 65,000 ft.

The *Sherpa* has been developed as a private venture but is doubtless designed to test layouts for larger machines. Originally flown as a glider, it was later slightly modified—following slight damage during a towed take-off accident—and fitted with two small Blackburn *Palas* turbojets (Turboméca licence) of 350 lbs. thrust each. The two engines are mounted in the fuselage and are fed by a common dorsal intake. The jet pipes are mounted separately on the sides of the fuselage, immediately beneath the wing. The wing is mainly of wooden construction and has a leading edge sweep of 42° 22′; its main spar is situated on the 25 % chord line. The rotating wing tips, which serve as both elevators and ailerons (elevons), are hinged at about 30 % chord and comprise about one fifth of the total wing area. Elevons are operated from a normal control column, which gives the required up and down and differential movement to the elevons via a special system of tubes.

The single-seat experimental aircraft is used only for investigating flying behaviour at relatively low speeds. With a gross weight of 3,125 lbs., the *Sherpa* has a max. speed limited to 130 knots in high-speed altitude and to 90 knots with flaps down.—As the pictures show, the *Sherpa* looks very small next to the Short SA.4 four-jet bomber (second prototype with modified nose to carry bomb sighting equipment); its span is 38 ft., length 31 ft. 10½ ins. and max height 9 ft. 1.12 ins.



* Cf. No. 10, 1953, pp. 596 and 597

Progress in Pictures

Bell X-1 A reaches Mach 2.5 . . .

On December 12th, 1953, Major Charles E. Yeager reached a speed of Mach 2.5 in the Bell X-1 A rocket research aircraft over Edwards Air Force Base, Muroc, California. Under the given atmospheric conditions and at the mean altitude reached, this corresponds to a speed of roughly *1,650 m.p.h.* According to hitherto unconfirmed reports, the maximum altitude reached during the "historic" flight was about 89,000 ft.

Few structural details are available. All that is known definitely is that the X-1 A is a larger development of the X-1 of 1945. Principal material used is duralumin; the surface is highly polished but not painted, except for the under wing surface and the centre axis of the fuselage underside, which are painted white to assist identification in photographic flight records. Power plant is a Reaction Motors Inc. bi-propellant rocket engine with a thrust of 6,000 lbs; the four units of this engine can be used either singly or in any desired combination.

According to the makers, the X-1 A was designed for speeds of around 1,700 m.p.h., so that Major Yeager's flight nearly reached the top performance limit. The following data for the X-1 A and its predecessor the X-1 are given for purposes of comparison:

	Bell X-1 a	Bell X-1
Span	28 ft.	28 ft.
Length	35 ft. 7 ins.	31 ft.
Height	10 ft. 8 ins.	10 ft. 8 ins.
Propellant (liquid oxygen plus water/ alcohol mixture)	11,000 lbs.	5,100 lbs.
Endurance at full thrust	4 min. 12 sec.	2 min. 30 sec.
Gross weight	18,000 lbs.	13,400 lbs.

New 20-mm anti-aircraft gun

A special credit of 100,000,000 francs was granted at the end of 1953, under the programme for modernizing Switzerland's air defences, for production of the Type 6 ILa/5TG 20-mm anti-aircraft gun developed by Oerlikon Machine Tools, Bührle & Co., Zürich. With a rate of fire of 1,000 rounds per minute and a muzzle velocity of 1,120 m/sec, its shells contain a new explosive with incendiary effect. By sub-contracting widely, it will be possible to supply the first models to the forces for training purposes by the spring of 1954. It should also be mentioned that an undisclosed number of these guns was supplied to the Belgian Army in December 1953.

What's in the Air?*

AVIATION POLITICS

• European air transport conference

The Conference on the Coordination of Air Transport in Europe sponsored by the International Civil Aviation Organization is to be held in Strasbourg beginning on April 21st, 1954. Twenty European countries have been invited to take part, and other I.C.A.O. members, as well as 13 international organizations, are to send observers.

• Air transport negotiations between Great Britain and Switzerland

Speaking at the 12th National Swiss Aviation Conference on December 7th, 1953, Swissair President Dr. Walter Berchtold referred to the difficulties experienced by Switzerland in obtaining commercial landing rights in other countries, including Britain. At the same time, he pointed out, Swissair is economically dependent on expansion of its overseas network.—It is hoped that these difficulties will be cleared up during current discussions in London. The Swiss delegation sent to Britain for this purpose includes Legation Councillor Egbert von Graffenried (who heads the mission); Dr. E. Steck, Federal Air Office; Dr. Heinz Haas, Secretary General of Swissair; Hans Aeppli, Swissair Deputy Director.

Air Force chiefs of the three N.A.T.O. regions, Southern Europe, Central Europe and Northern Europe, met at N.A.T.O. headquarters in Fontainebleau at the end of 1953 to coordinate plans for air defence from North Cape to the Bosphorus in 1954. Left to right: *General David M. Schlatter* (U.S. Air Force), Commander-in-Chief, N.A.T.O. Air Forces, *Southern Europe; Air Chief Marshal Sir Basil Embry* (R.A.F.), *Central Europe; General Warren R. Carter* (U.S. Air Force), *Northern Europe.*

* Extracts from *Interavia Air Letter*, daily international news digest in English, French and German. All rights reserved.

AIR TRANSPORTATION

• More than 50,000,000 passengers

The International Civil Aviation Organization reports that more than 50,000,000 passengers were carried by the world's airlines in 1953.

• Dr. Albert Plesman Airport

At a commemorative meeting in Willemstad, capital of Curaçao, in honour of the late President of K.L.M. Royal Dutch Airlines, it was decided to change the name of Hato Airport near Willemstad to "Dr. Albert Plesman Airport". (An obituary for Dr. Plesman by *Interavia's* Editor-in-Chief appears elsewhere in this issue.)

• German pilots training in England

Four pilots of the former Deutsche Lufthansa (and three ground personnel) arrived in England at the beginning of January to take a three-months training course at Air Service Training Ltd. (part of the Hawker Siddeley Group) on de Havilland *Chipmunks*, Airspeed *Oxfords* and de Havilland *Doves*. They are later to go to the United States for training on Convair-Liner 340s.—On completion of their training, the pilots will serve as captains of the Convair 340s to be supplied to the new Lufthansa in the spring.

• Silver City car fares below shipping rates

Silver City Airways announce further reductions in rates on their cross-Channel vehicle ferry services for the 1954 season. The new rates are now lower than shipping rates (including insurance). On the Lympne–Calais route, for example, a Morris Minor will now be carried for £6 1*s.* 6*d.* compared with £7 10*s.* 0*d.* in 1953 and £16 in 1952. When the ferry service was first introduced in 1948 the return fare for a Morris Minor with two passengers, now £21 3*s.* 0*d.*, was £54.

SERVICE AVIATION

• Civilians replace U.S.A.F. ground personnel in Britain

During 1954 some 4,000 U.S. Air Force ground crew members in Great Britain are to replaced by local civilians.

• German ground personnel for U.S. bases

U.S. Air Force Command in Germany plans to employ 3,500 German civilians for ground and supply services.

• Costly training

The Royal Canadian Air Force states that the training of an Air Force pilot now costs no less than $90,000. The figure for other flying personnel—navigators, radio operators, etc.—is $75,000.

INDUSTRY

• Sir Thomas Sopwith warns British industry

Speaking at the 18th Annual General Meeting of the Hawker Siddeley Group, Sir Thomas Sopwith, the Group's Chairman, delivered a serious warning to British industry. "Through timidity and complacency the lead Britain once held in jet power has not only been cut down but in some respects lost entirely." He urged Britain to "be bold as it moves into the age of rockets, guided missiles, atomic and thermo-nuclear power." Referring to Britain's latest bombers and fighters, he said that they are merely "the aircraft of today and the immediate tomorrow . . . We as a nation should now be spending vast sums of money on high altitude and high speed research . . . The

Mademoiselle Berthe Lorrette in the Nord *Norécrin II* (135 h.p. S.N.E.C.M.A.–Régnier engine) belonging to Mascara Aero Club, in which she made a 25,260-mile tour of the Sahara, Algeria, Tunisia, Morocco, Sicily, Spain and Italy.

Lockheed F-94C *Starfire* jet fighter and T-33 jet trainer at Lockheed's Burbank airfield, ready for delivery to the U. S. Air Force.

Sound muffling installation for jet engine test runs a Canadair Ltd., Montreal.

Vickers-Supermarine Swift FR. 5: Fighter and reconnaissance version; photographic equipment in the fuselage nose.

ultimate defence of our country, of Western Europe and of the free world lies in the realm of flight at several times the speed of sound, coupled with high altitude research."

● International Materials Congress, Paris, 1954

The *Association pour l'Encouragement à la Recherche Aéronautique* announces that it is to hold an International Congress on Materials for Aircraft and Rocket Production in Paris during the summer of 1954. The programme for the Congress, which will last a week, includes lectures on materials and production processes in general; cold and heat resistant metals (—80 °C to +70 °C, and 100 °C to 3,000 °C); mineral materials; organic materials; fuels (for piston engines, turbojets, pulse-jets and ramjets, rockets); anti-corrosion substances, etc.

● Design contest for miniature helicopters

An international design contest for miniature helicopters is to be held during the 6th Trade Fair at St. Etienne (September 16th to 27th, 1954).

● Japan to make guided missiles?

A number of Japanese firms are planning to take up the production of guided missiles. Leading aircraft and engine manufacturers and producers of electronic equipment, such as Shin Mitsubishi Juko (airframes and engines), Kawasaki Aircraft (airframes), Nihon Electric (control instruments), have already obtained foreign technical documentation and are reorganizing their technical staff to meet the new requirements.

Hiller HOE: Five of these small two-seat helicopters with ramjet propulsion are to be supplied to the U.S. Navy, Marine Corps and Army for testing in the spring of 1954. The HOE (Army designation H-32, works designation YHJ-1) is derived from the *Hornet*, but has a tail rotor instead of the latter's rudder.

SPORTS FLYING

● "Supersonic Minister"

On December 29th, 1953 a twin-jet SO 4050 *Vautour* piloted by Captain Glavany reached supersonic speed over Istres air base. His passenger was Louis Christiaens, French Secretary of State for Air . . . the first "supersonic minister."

FLYING EQUIPMENT

● Avro-Canada is building the prototype of the CF-105 twin-jet all-weather delta fighter for the Canadian Government. According to first releases, speed in level flight is to be about 1,200 m.p.h., and range approx. 1,500 miles. Armed exclusively with guided missiles and equipped with the latest radar installations, the fighter will probably be about twice as heavy as the 17-ton Avro-Canada CF-100.

No official information is available about projected power plant, but it is believed it may be an improved version of the Bristol *Olympus* or the Rolls-Royce *Conway*. The *Super Orenda* project, known as the TR-8, on which Avro-Canada is working, may also be considered.

● Douglas Aircraft Co., Santa Monica, Calif., recently announced an overwater version of its four-engined *DC-7* commercial transport. Fitted with four 3,250 h.p. Wright R-3350 compound engines, the type can be equipped for 58 passengers in the standard version for day services, 55 passengers in a combination version with seats and sleepers, 88 passengers in the tourist class version.

The new overwater DC-7 (or DC-7B) has a maximum gross weight of 125,000 lbs., a fuel capacity of 6,260 U.S. gallons, a mean cruising speed of 361 m.p.h. at 24,300 ft. with a power of 1,800 h.p. per engine.

● In a recent series of articles in the leading Stockholm newspaper "Stockholms Tidningen" devoted to the Swedish Air Force's future equipment policy, first mention was made of a new supersonic fighter, presumably with delta wing, designated J 35. The paper believed that the type would be ready for flight testing in 1955. No confirmation is available from the Swedish Air Force.

FIRST FLIGHTS

● *The Hurel-Dubois HD 32* passenger and cargo transport fitted with two 1,200 h.p. Pratt & Whitney engines began flight testing at Villacoublay on December 29th, 1953. Air France has ordered 24 of these aircraft, and four more are to go to the French National Geographic Institute.

● Shortly before the end of 1953, the *SO 1221 Djinn* two-seat helicopter prototype began flight testing.

● The *NC 856 H* float version of the NC 856 three-seat touring and communications aircraft made its first flight tests at Sartrouville (S.N.C.A. du Nord) in December 1953.

● Finally the *Hispano HA-100 E-1* single-engined low-wing trainer built by the Spanish firm of Hispano Aviación, made its first flight on December 10th, 1953.

POWER PLANT

● A glance at the development history of the *Pratt & Whitney J-57* axial-compressor turbojet shows how rapidly this engine's thrust has been increased during the past 18 months. The original J-57-P-1 version, fitted in the Boeing XB-52 bomber prototype, delivered a thrust of 8,700 lbs. The later J-57-P-3 model (Convair XF-102 and North American YF-100) delivers 9,200 lbs., the J-57-P-5 version 9,700 lbs., and a newer version—presumably the J-57-P-15, with which the Boeing YB-52 is now fitted—has a thrust of 10,900 lbs.—Finally a reheat J-57 has been tested at 13,900 lbs.

● Constant development work on the *S.N.E.C.M.A. Vulcain* turbojet has raised this engine's thrust to 11,020 lbs.

Payen P. 49: Single-seat experimental delta model with Turboméca *Palas* turbojet of 350 lbs. thrust.

Reheat Turbojet or Ramjet Propulsion ?

BY DR. ING. EUGEN SÄNGER, PARIS

The Problem

The speed ladder of the morphological development series of *fighters* :

propeller fighter	up to	750 km/h
turbojet fighter	up to	1,100 km/h
reheat turbojet fighter	up to	2,000 km/h
ramjet fighter	up to	4,000 km/h
anti-aircraft rocket	up to	12,000 km/h

is hastening the development of faster and faster propulsion systems and leads inevitably to a *corresponding series of bombers* :

propeller bomber	up to	650 km/h
turbojet bomber	up to	1,000 km/h
reheat turbojet bomber	up to	2,000 km/h
ramjet bomber	up to	4,000 km/h
rocket bomber	up to	26,000 km/h

The bomber thus ultimately remains superior.[1]

Because of the high cost and the time required for the development of rocket bombers, and in view of the permanent threat of war, it has hitherto been considered justifiable to work through all the intermediate stages of the main air weapons. Today we are confronted by the question of whether this attitude is correct in the case of the *reheat turbojet fighter*, i.e. whether preference should be given in the 1,000 to 2,000 km/h speed range to turbojet engines with afterburners or to pure ramjet engines.

The answer to the power plant problem will be a different one for fighters than for bombers, as the following considerations will show : *for speeds of between 1,000 and 2,000 km/h the reheat turbojet engine is preferable in the bomber and the pure ramjet in the fighter.*

[1] *Cf. Dr. E. Sänger* "The Future Evolution of the Bomber", in *Interavia* No. 3, 1952, pp. 139-143.

Fire temperatures

Increased fire temperatures in jet engines have the known effect of reducing the total propulsion efficiency and simultaneously increasing thrust.

When *atomic energy* is used, the first effect is a minor one, as efficiency here plays only a subordinate role.

But even when present-day *chemical fuels* are used, the second effect is regarded as very much more important, as is illustrated by the tremendous efforts being made to remove the limitation of fire temperatures to about 1,200°K (930°C) by using turbine-blade materials with a higher heat resistance or by cooling the turbine blades.

This limitation on fire temperature largely becomes inoperative in afterburner chambers and ramjet combustion chambers when the full speed of the air flow is used for cooling the combustion chamber walls, so that the full temperature increases (roughly 2,000°C) of the stoichiometric combustion of normal hydrocarbons in air become technically utilizable.

This fact has been confirmed by the author in a great many flight tests for altitudes between 0 and 7 km, Mach numbers of between 0.3 and 0.6 and combustion chamber diameters of between 0.5 m and 1.5 m ; the combustion chamber walls never got beyond the dark red glow visible only at night.

Fig. 1 extends these results, obtained over a narrow range, to the whole range concerned. The following remarks apply here :

Because of the high fire gas temperatures, heat transfer inside the engine takes place chiefly through *radiation* of the CO_2 and H_2O molecules, for which complete tables are available. The ultra-red absorption of the scaly, corroded and sooty inner wall surface is assumed to be 90 %.

Convection of the combustion gases plays a small part compared with radiation, because of the relatively low gas density and velocity. Moreover the gas velocity has a very clearly marked profile over the section, so that velocities near the wall are greatly reduced. Finally, the combustion gas temperature is so distributed over the section that temperatures near the walls are also substantially lower. Convection does not become slightly more noticeable until the throat section, where as a rule radiation is already lower. For this reason wall temperatures here were lower than on the combustion chamber wall during the flying tests.

Heat transfer from the hot engine wall to the atmosphere, on the other hand, is primarily by convection and can be calculated approximately by means of the usual formulae for turbulent flow. The fixed values in the convection formula are determined from the flight test results ; flying speed is entered as speed of flow, the density used is that of the undisturbed outside air, and temperature that of the latter plus frictional heating ($0.85\,v^2/2000$).

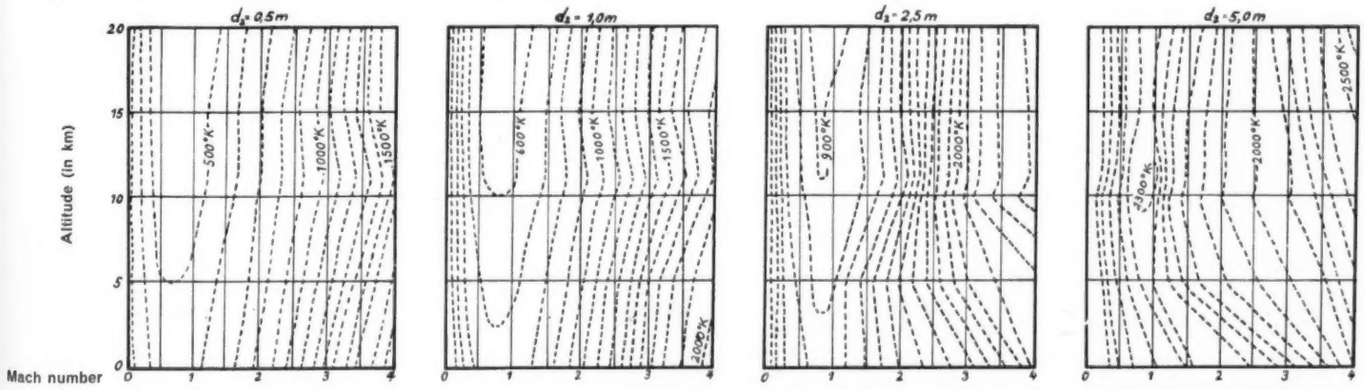
Radiation from the walls becomes of marked effect only above wall temperatures of 1,500°K.

With these conditions assumed, the wall temperatures at which the heat flows mentioned are in balance are extrapolated in *fig. 1* for the Mach number range of 0 to 4, altitudes of 0 to 20 km and combustion chamber diameters of 0 to 5 m.

*

At a given altitude the wall temperature first decreases with increasing Mach number, as the convection of the air flow becomes increasingly effective. The wall temperature generally reaches its minimum before sonic

Fig. 1 : Isotherms of sustained wall temperatures in ramjet combustion chambers cooled by air flow, with stoichiometric hydrocarbon combustion and 90 % ultra-red absorption by the wall surface, plotted against Mach number, altitude and combustion chamber diameter d_2. *(Extrapolation from flight test results, according to "Deutsche Luftfahrtforschung" UM 3509 and NACA TM 1106).*



speed is attained, and then rises to very high values. This increase in wall temperatures at higher flying speeds is due on the one hand to the frictional effect of the air flow, and on the other to the increasing density of the radiating combustion gases caused by their compression (straight shock wave) in the diffusor and the increasing thickness of their outer layer.

Whether, with fixed Mach number and increasing altitude, the wall temperature rises or falls depends entirely on whether the thickness of the radiating outer layer is still small (e.g. small combustion chamber diameter, low flying speed), or whether it must already be considered as very large. In the former case the radiation intensity generally decreases more rapidly with the air density than does convection, *so that the walls become cooler at greater altitudes.* In the other case intensity first varies little with air density, while convection continues to decrease, and *the walls get warmer with increasing altitude.*

Because of this interplay by the radiation layer thickness, the influence of the combustion chamber diameter on wall temperature —under otherwise similar conditions—is very considerable, as long as the effective layer thicknesses remain relatively small, but disappears when the radiation layer thicknesses approach *infinity* (high Mach numbers, large combustion chamber diameters, low altitudes).

The influence of combustion gas dissociation on wall temperature has not been considered more closely, since it falls within a technically unimportant range (very great altitudes, small Mach numbers).

The general range of high sustained wall temperatures at very small Mach numbers, shown in *fig. 1*, is also technically uninteresting, as it is passed through rapidly during take-off.

If it is not possible to raise the ultra-red reflection of the combustion wall surface above the 10 % assumed here, the maximum temperature limit of high heat-resistant steels (roughly 1,500°K) in the stratosphere is reached at the following figures :

with a 0.5-m combust. chamber, at Mach 3.7,
with a 1.0-m combust. chamber, at Mach 3.2,
with a 2.5-m combust. chamber, at Mach 2.2,
with a 5.0-m combust. chamber, at Mach 1.1.

*

The technical means of extending this thermal speed limit in ramjet propulsion are :

Use of better heat-resistant structural materials ;

Reduction of effective radiation layer thicknesses by suitable arrangement of the combustion chamber section ;

Increase in ultra-red reflecting power of the inner wall surface ;

Use of fuels which produce combustion gases with a smaller spectral range, e.g. fuels with lower hydrogen content ;

Suitable optical adaptation of combustion gas and wall surface.

By these means it should be possible to open up the whole Mach number range up to Mach 4 to stoichiometric ramjet operation. A final way out is still offered by the use of sub-stoichiometric combustion in sustained flight, at the expense of thrust density.

These difficulties would appear to be considerably greater for the afterburner chambers of turbojet engines. Although *fig. 1* applies primarily to pure ramjet propulsion, it can also be used approximately for reheat turbojet propulsion, by multiplying the geometric diameter of the afterburner chamber by the compression ratio of the compressor and the expansion ratio of the turbine, and then using the diagram corresponding to this " effective " diameter.

In this way an afterburner chamber, 1 m in diameter, can reach the unfavourable wall temperature conditions of the 5-m ramjet combustion chamber. Thus, we find that the thrust density of the reheat turbojet in the Mach 1 to 2 range (compared with the pure ramjet) is limited to sub-stoichiometric combustion, since not all of the improvements listed above for the ramjet can be applied to the reheat turbojet.

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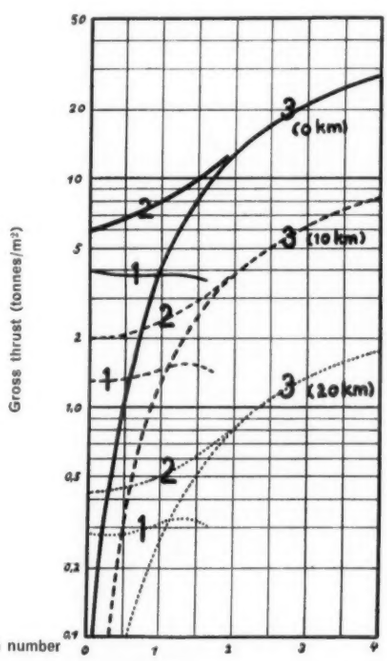

Fig. 2 : Gross thrusts (in tonnes) per square metre frontal area of turbojet engines without afterburners (1), reheat turbojets (2) and pure ramjets (3), plotted against Mach number and altitude. The unbroken curves apply to 0 km altitude, the broken ones to 10 km altitude, and the dotted ones to 20 km.

Stoichiometric combustion at high Mach numbers can therefore probably be used only in ramjet engines but not in reheat turbojets.

If we nevertheless assume stoichiometric combustion for both types of engine in the following comparative considerations and still come to the conclusion that ramjet propulsion is superior for *fighters*, this result will be even more reliable, while the actual superiority of the reheat turbojet as a power plant for bombers is still further increased by sub-stoichiometric afterburning.

Superiority of the reheat turbojet

Although for the purposes of comparison we must regard the combustion temperature of turbojet engines as being limited to 1,200°K, we are justified in assuming that the total air oxygen is consumed in the reheat turbojet's afterburner and the ramjet's combustion chamber so that temperature increases of the magnitude of 2,000°C occur.

This gives roughly the gross thrusts shown in *fig. 2* for the three types of engine considered. They are plotted against Mach number and altitude (as parameter) and given in relation to the frontal area of the engine in square metres.

For the turbojet engines the more favourable values of engines with axial compressors have been entered. For supersonic engines the most unfavourable case of a diffusor with perpendicular shock wave at the diffusor entry is taken throughout.

The best turbojet engines are all surpassed by the ramjet engines, as regards thrust density, at about Mach 1.

The reheat turbojet engines with the above-mentioned high afterburner temperatures have roughly 50 per cent higher thrusts at moderate Mach numbers than corresponding turbojet engines without afterburner. This superiority increases, as Mach 1 is approached, to roughly 110 per cent near the ground, 65 per cent at 10 km and 56 per cent at 20 km altitude. It is thus smaller at high altitudes than near the ground.

The superiority of the reheat turbojet over the pure ramjet at Mach 1 is about 85 per cent near the ground and remains at roughly the same figure at all altitudes. Only at Mach numbers in the neighbourhood of 2 does superiority in thrust density sink to such an extent that the ramjet becomes equal or superior. At this Mach number the absolute values of gross thrusts are still roughly 3.7 tonnes/m² at 10 km and 0.8 tonnes/m² at 20 km altitude.

Beyond Mach 2 the ramjet engine is the only one which is utilizable in practice until it reaches its speed limit at Mach 4 owing to the wall temperature conditions already mentioned. At this speed, thrusts are still more than 8 tonnes/m² at 10 km and 1.7 tonnes/m² at 20 km altitude.

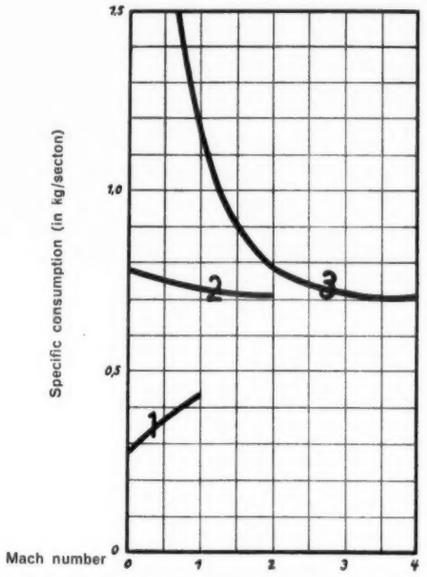

Fig. 3 : Specific fuel consumption (in kg) per unit momentum (in sectons) for turbojets without afterburners (1), reheat turbojets (2) and pure ramjets (3), in the stratosphere, plotted against Mach number.

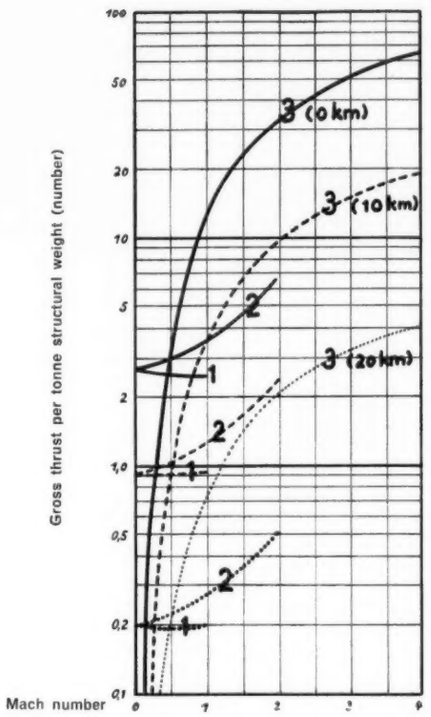

Fig. 4 : Gross thrusts (in tonnes) per tonne structural weight for turbojets without afterburners (1), reheat turbojets (2) and pure ramjets (3), plotted against Mach number and altitude. The unbroken curves apply to 0 km altitude, the broken ones to 10 km, and the dotted ones to 20 km.

What is more important than the superiority of the reheat turbojet over the ramjet in thrust density (in the speed range between Mach 1 and Mach 2) is specific fuel consumption per unit momentum.

Fig. 3 shows the specific fuel consumption in kg/secton (the value in kg/kph is obtained by multiplying by 3.6), again plotted against Mach number.

This specific fuel consumption J is connected, as is known, with the total propulsion efficiency η, by the simple formula :

$$\eta = v/JH$$

Here H equals the heating value of the fuel. If, for example, J over speed v is constant, efficiency η increases proportionally with speed v.

The considerably lower fuel consumption of the turbojet engine without afterburner is due primarily to the lower combustion temperature, and therefore should not be compared directly with the other two curves, which apply to much higher combustion temperatures. Reheat turbojet and pure ramjet propulsion give lower consumptions at correspondingly lower combustion temperatures, though at the expense of the thrust densities shown in *fig. 2*.

On the other hand, the two upper curves can be compared : at Mach 1 fuel consumption of the ramjet (1.15 kg/secton) is still 60 % higher than that of the reheat turbojet. At *Mach 2* the consumptions of both engines have come very close together at about 0.75 kg/secton ; the engine efficiency of 19 % is relatively small in view of the generally unfavourable L/D ratios of supersonic aircraft for long ranges at this speed.

At *Mach 4* the specific fuel consumption of the high-temperature ramjet is about 0.7 kg/secton, which corresponds to $\eta \sim 40$ % ; this promises to give considerably better ranges at this Mach number because of the more favourable L/D ratios.

The incontestible superiority of the reheat turbojet over the pure ramjet in the speed range Mach 1 to 2 as regards thrust density and efficiency makes the former engine appear more suitable for long-range aircraft such as bombers, as long as for any reason it is not possible to exceed this unfavourable Mach range, e.g. as long as we limit ourselves to delta-wing aircraft with extreme sweep and subsonic airfoils.

Superiority of ramjet engines

Whereas the superiority of the pure ramjet engine over the turbojet in *bombers*, as regards thrust density and fuel consumption, does not appear until beyond Mach 2, this happens in the case of *fighters* at much lower speeds.

Value P/G means thrust per tonne structural weight of the engine. This value is plotted in *fig. 4* for the three types of engine considered, against Mach number and altitude. The value for the ramjet engine exceeds that of the two other types of engine at Mach 0.5 and is 3 to 5 times as high at Mach number 1 to 2.

In long-range aircraft engine weight is as a rule roughly equal to the drag in horizontal flight. Here P/G values of approximately 1 are sufficient. These are reached by turbojet engines without afterburner at the lower limit of the stratosphere and by reheat turbojets at an altitude of about 15 km.

In fighters, on the other hand, we must still demand almost vertical climb at 10 km, i.e. value P/G must be still above 5 at this altitude ; this can be obtained with ramjets but not with either of the other engine types.

*

The P/G figure, however, has another far-reaching significance ; production costs of turbojets are between 25 and 50 dollars per kg of structural weight, according to the number produced. Hence the engines of a 100-tonne supersonic bomber cost about 1,000,000 dollars, which is not out of proportion to the cost of an atom bomb. The development of these heavy missiles limits strategic bomber forces to small units of highly specialised aircraft. The economic conditions are therefore very different from those which apply to fighters, which are always required in the greatest possible numbers.

The lower structural weights of the ramjet engine per unit momentum give them a notable economic superiority because of their much lower production costs. For fighters, whose life in wartime is only a few hours, high-performance turbojet engines are an unjustifiable luxury.

For example, the proposed annual production in the U.S.A. of 20,000 reheat turbojet engines each weighing 2,000 kg will cost a round sum of 1,000,000,000 dollars, or roughly one twelfth of the American air budget. Another example : even with an annual war output of 100,000 fighters (each with a life of ten hours) only 114 fighters can be operational at any given moment (!). Yet this production costs about 15,000,000,000 dollars, or ten per cent of the total European national income. The fuel consumption of these fighters—perhaps 2,000,000 tonnes— on the other hand costs less than one hundredth of this sum.

It would therefore seem to be senseless to use more costly engines to get a slightly better efficiency if the empty weight of the fighters and hence annual production costs can be reduced by half by using the cheaper ramjet engine. At the same time critical materials could be avoided and better flying performance obtained. The lower wing loading of ramjet fighters would give better manœuvrability at combat altitude, greatly improved rate of climb and flying speed.

The fact that ramjet aircraft require special take-off power units is sometimes regarded as a disadvantage. In war aircraft, however, it is exactly the contrary. That the heavy and expensive take-off equipment (and the extra weight of reheat turbojets)

need no longer be carried along during climb, flight and landing and cannot be destroyed in battle (thus leaving them free to be used again) can only be regarded as a technical and economic advantage.

Take-off from a mobile ramp will become the rule, particularly when crews disappear from fighters and when the costly solid-propellant rocket is replaced by the cheaper liquid rocket, using propellants with high water content.

*

We must therefore accustom ourselves to regarding aeroplanes as air vehicles rather than as combined air and ground vehicles.

If the ramjet fighter with a gross weight of 7 tonnes and purchase price of 200,000 dollars carries out only twenty flights in wartime, each flight costs 10,000 dollars. Take-off on each of these flights using JATO rockets would cost about 600 dollars, with liquid rockets less than a tenth of this sum, i.e. a low price compared with the cost of the flight.

These considerations show that its superior thrust per unit structural weight makes the ramjet definitely superior to the reheat turbojet in fighters, i.e. that the development of reheat turbojet fighters for the speed range of 1,000 to 2,000 km/h is technically and economically wrong.

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The Mind of Mr. Reader...

Dear Sir,

Our attention has been drawn to the publication in No. 12, 1953 of your *Review* of a table of records entitled "Faster and Higher", headed by an alleged performance of 50 km/h by the Wright Brothers in 1903.

The inclusion of this figure may give the impression that it was a record officially homologated by the Fédération Aéronautique Internationale. However, the F.A.I. did not exist at that time. I would therefore suggest that you publish a note . . . to the effect that this performance was not homologated by the F.A.I. The first speed record officially timed by the *Fédération* was that of Santos Dumont, at a figure of 41.292 km/h. It seems to us slightly ludicrous to give as a record a figure that exceeds the subsequent one by more than 8 km/h.

If at some later date the reader refers to your table, he may be misled by your mention of the Wright Brothers' performance without further explanation . . .

Paris — H. R. GILLMAN,
Director General,
Fédération Aéronautique Internationale

Interavia gladly makes the suggested correction, and would ask readers to delete the speed figure for the Wrights' flights on p. 706 (No. 12, 1953). The figure of 50 km/h came from a usually reliable American source and should evidently be taken merely as an estimate. According to Orville Wright's records, his brother covered a distance of 852 feet (260 m) in 59 seconds, which represents a ground speed of only 10 m.p.h. (16 km/h).—It should be added that Lt. Col. William F. Barns flew at an officially measured speed of 1,151.9 km/h (715.8 m.p.h.) on July 16th, 1953 (in his F-86D), i.e. a higher figure than the one given in the same table. —Ed.—

Dear Sir,

I feel I cannot renew my subscription to a Review which considers Clément Ader and his work as a manifestation of French chauvinistic imagination . . .

Yssingeaux (Haute-Loire) — M. PIRIOU

Nothing was further from *Interavia*'s thoughts ! —Ed.—

Dear Sir,

I have been a devoted reader of *Interavia* for several years and feel that I must compliment you on the success of your cover pictures in full colour.

The quality of the contents and the photography make *Interavia* a real pleasure to read.

Paris — J. LECA

Dear Sir,

We have read the issue of your Review devoted to 50 Years of Powered Flight . . .

While we appreciate the exploits of the Wright Brothers, who were welcomed and fully honoured in France, we were sorry to see that your writers did not pay greater attention to the first heavier-than-air flight by the gifted Clément Ader . . .

It is well known that Santos Dumont's records, both for speed and for distance, were the first in the world to be officially recorded by the Aero Club of France and later by the F.A.I. . . .

Paris — JACQUES ALLEZ
President
Aero Club of France

Interavia agrees with Monsieur Allez that Clément Ader's pioneering achievements should not be forgotten. Readers are referred to (1) *"Clément Ader : Through Disappointment to the Final Goal"* in No. 12, 1947, to mark the 50th anniversary of Ader's second flight ; (2) *"The First Half-Century of Aviation"*, by C. G. Grey in No. 6, 1951, which states that "France can claim the credit for the first heavier-than-air machine off the ground" ; (3) the Leading Article by *Interavia*'s Editor in No. 12, 1953. —Ed.—

Jean Jenni

We regret to announce the death on January 12th, 1954 of our colleague Jean Jenni, at the age of 53, after a long illness and severe operation. In his youth a well-known Swiss and Olympic swimmer, he went to Southern France in the 'twenties as a sports writer. After the war he returned to Switzerland and joined the French editorial staff of *Interavia* in 1946, where, being a born journalist, he became a very competent aviation writer whose polished style proclaimed his love of the French language and French culture. Good-natured and with a great sense of humour, he was a loyal friend and colleague, who will not be forgotten among us.

INTERAVIA

Book Reviews

Soviet Military Doctrine, by Raymond L. Garthoff. Prepared under the research programme undertaken for the U.S. Air Force by The RAND Corporation. The Free Press, Glencoe, Illinois, 1953. English, 587 pages, price $7.50.

The less is known about Russia, the more is written about it... as a rule by men to whom the Russian alphabet is a sealed book. In the military field this flood of popular publications presents an obvious danger.

But now, eight years after the end of the war, there has appeared a serious investigation into Soviet military principles, which should put an end to the period of conjecture. The RAND Corporation (*R*esearch *and D*evelopment Corp., founded by the U.S. Air Force at the end of 1948) commissioned one of its members (a sociologist, not a professional soldier !) to work through the gigantic material on the subject. The bibliography at the end of the book fills no less than 58 pages and is subdivided under eight headings : *a)* Official Soviet Regulations and Manuals ; *b)* Soviet Sources : Books and Pamphlets ; *c)* Soviet Sources : Selected Recent Periodical References ; *d)* Soviet Sources : Radio Moscow and Tass ; *e)* Former Soviet Sources ; *f)* German Sources ; *g)* Non-Soviet Commentaries on Soviet Military Affairs ; *h)* Selected Non-Soviet Commentary References.

Organization and tactics of the Red Air Force were already known from Wing Commander Asher Lee's excellent monograph, " The Soviet Air Force ", published in 1950. However, it has taken the work of a non-soldier, Garthoff, to show how essential is an overall review of the historical, political and strategic principles, against which the details of the air force sector can be reliably judged.

It is greatly to be hoped that nobody will in future write on Russian military questions without first reading this book.

He.

Equipages à l'action, by J. Noetinger. Presses Mondiales, Paris, 1953 (French, 125 pages).

If there is a man in France whose knowledge of the world of flying is complete it is J. Noetinger. An enthusiastic pilot, he spends a good part of his time at flying centres, trying out every aircraft he can lay his hands on, from the smallest machines built by amateurs up to the biggest commercial transports, not forgetting jet fighters and trainers. Every week he writes a lively article, for a well-known Paris aviation magazine, on his impressions at the controls of his latest aircraft. It is impossible to be in daily contact with design offices, factories and airfields without gaining a wide knowledge of the men whose whole existence is devoted to aviation. Monsieur Noetinger has here collected together a series of portraits of the men who are actively contributing to the rebirth of French aviation. A striking point which emerges from these portraits is the spirit of solidarity which reigns in the aviation world, where designer, pilot and mechanic all show the same determination, energy and enthusiasm. The text is supplemented by a collection of photographs of recent French aircraft, by J. Dengremont, a true artist in his medium.

La.

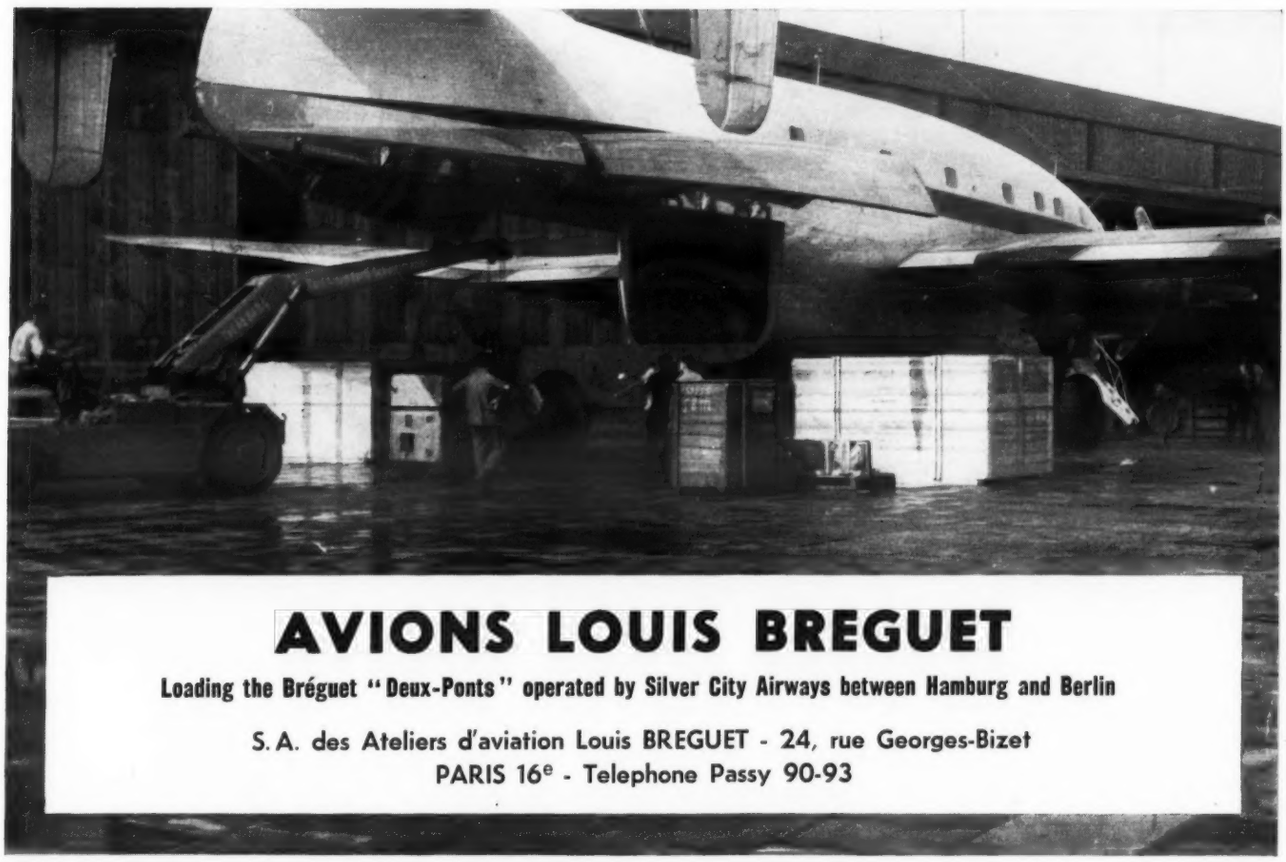
Discontinuous Automatic Control, by Dr. Irmgard Flügge-Lotz. — Princeton University Press, Princeton, New Jersey, 1953 (English : 168 pages ; 102 diagrams ; price $5.00).

Dr. Flügge-Lotz published her first mathematical investigations into the motion of an oscillating body with on-off control in Germany during the war, in collaboration with K. Klotter (now professor at Stanford University), H. Hodapp and H. Meissinger. After the war she continued her work at Stanford University, in the United States, and discovered a means of replacing tedious calculations by graphical processes.

Discontinuous automatic systems (on-off control) are frequently used in controls for guided missiles, because they are simpler and less costly than continuous systems.

The book will be well received amongst engineers in this field.

Ri.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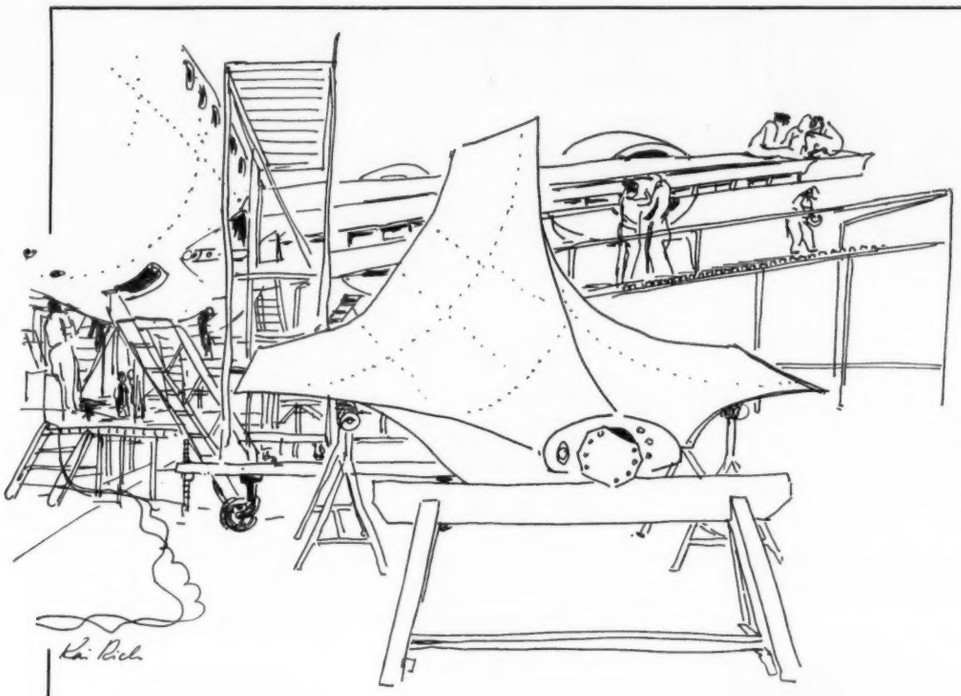

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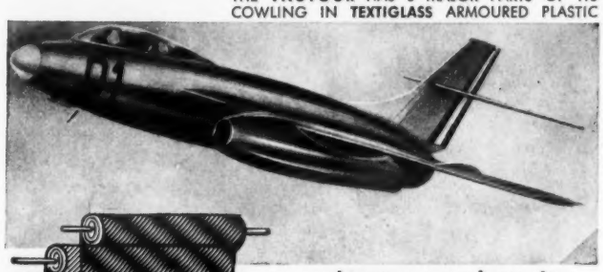

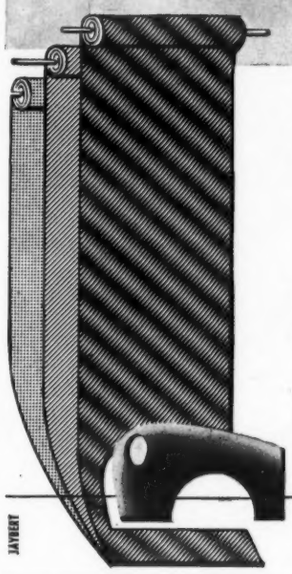

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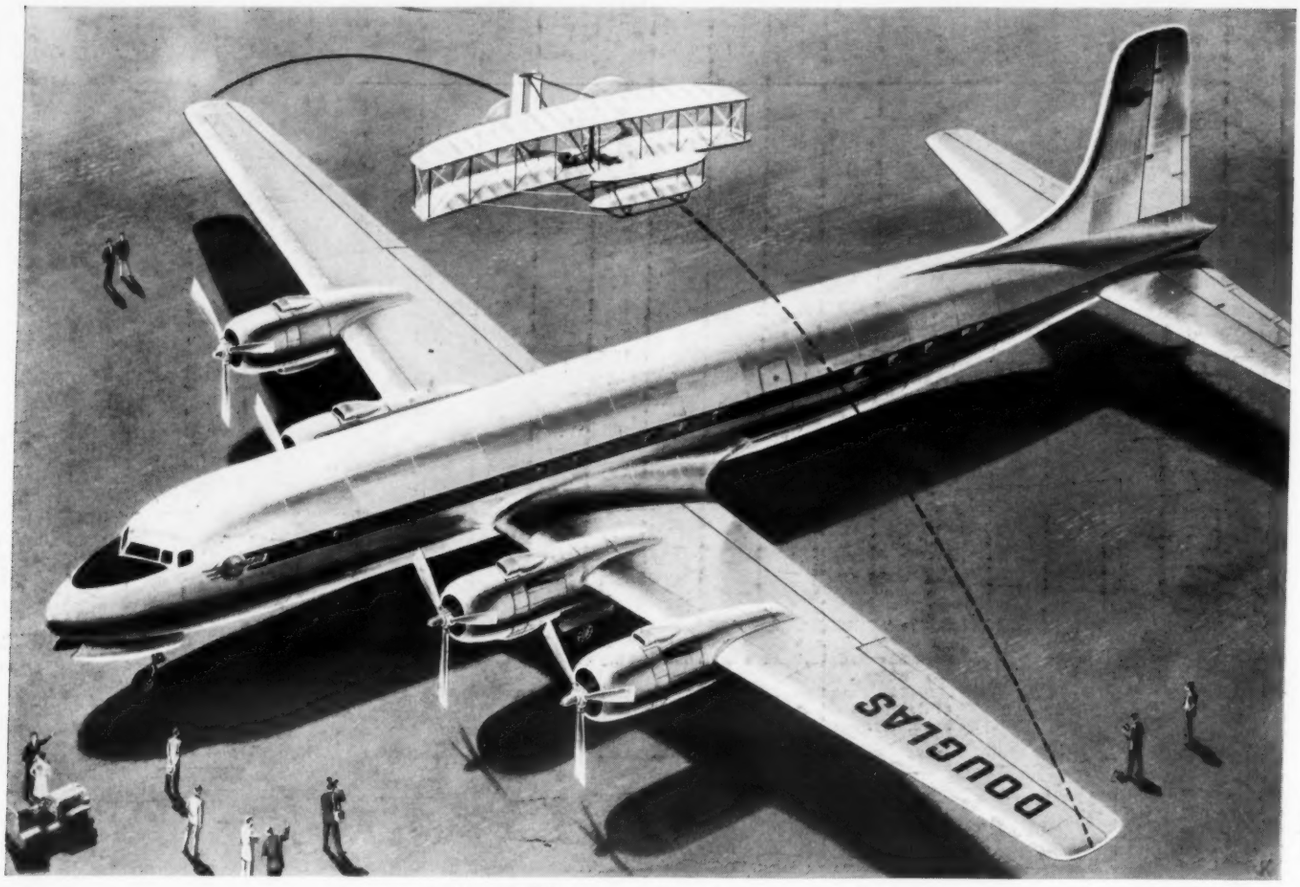

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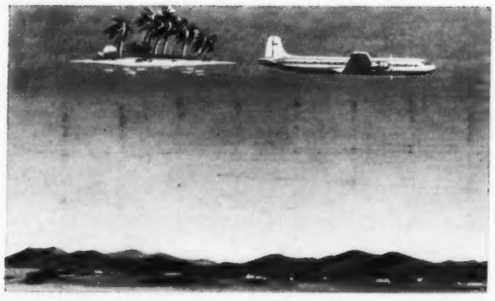

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